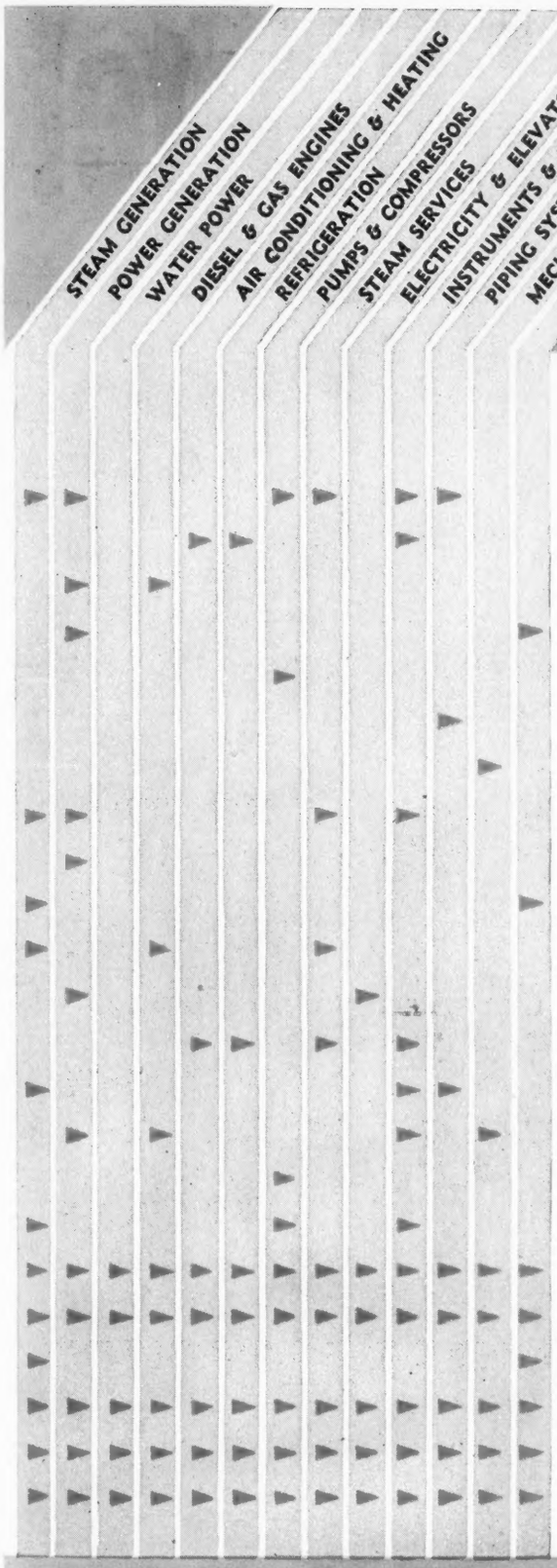

POWER

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MARCH, 1940

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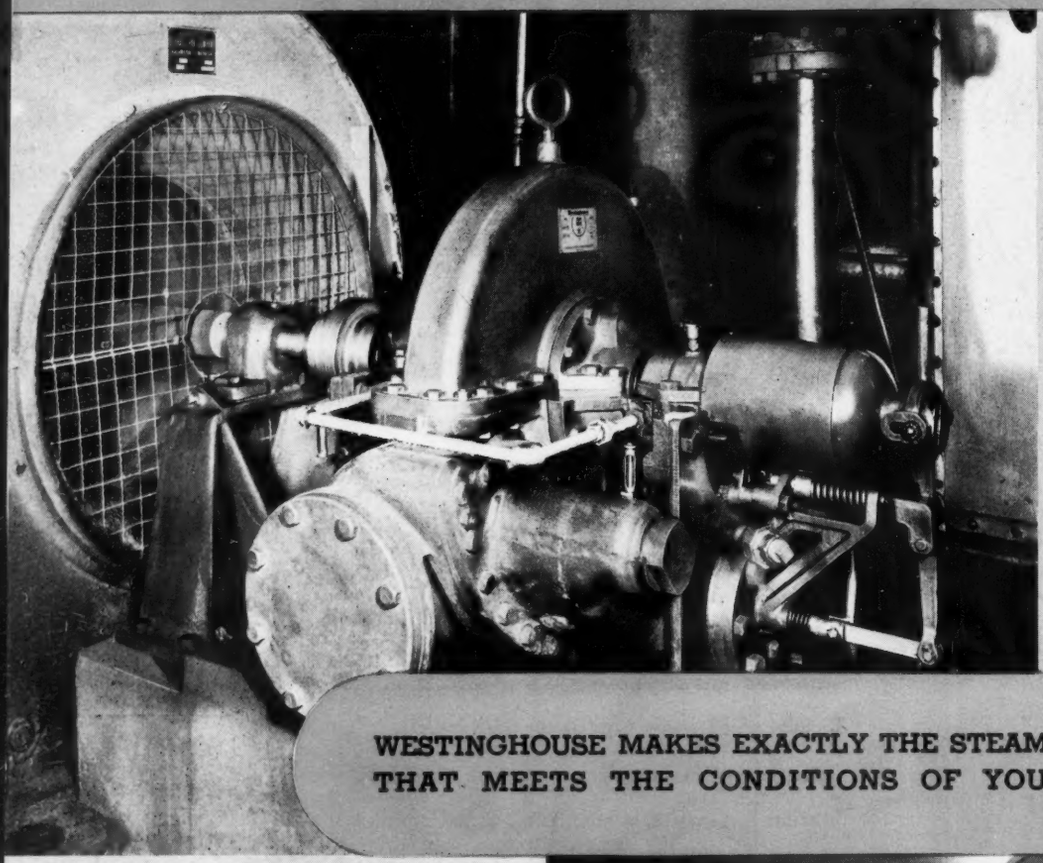

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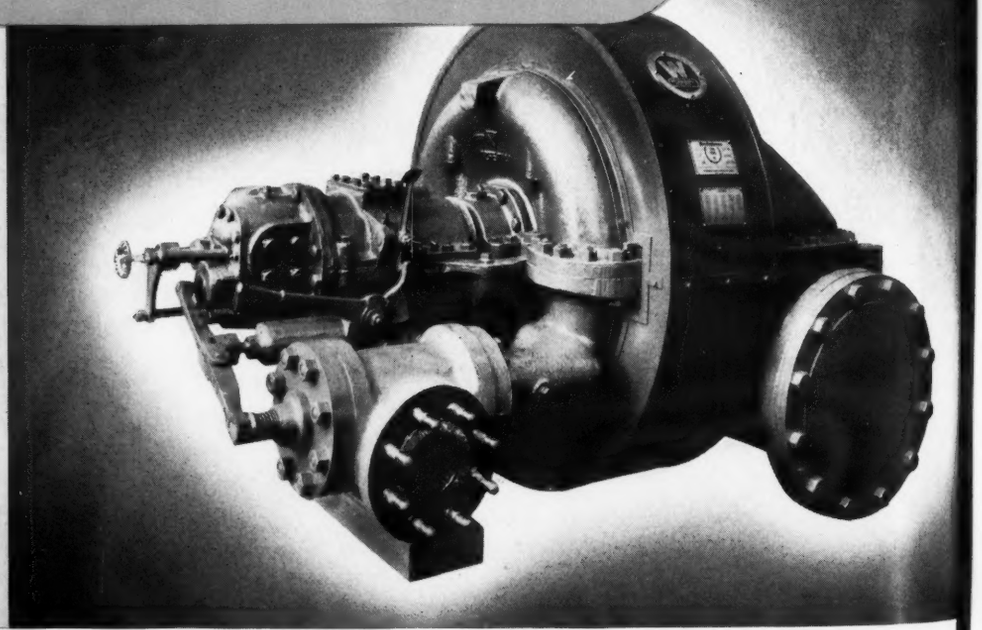

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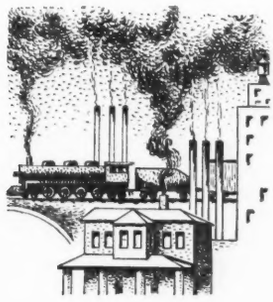


Common Sense in Smoke Prevention

One of the surest indications of returning prosperity is the renewed attack on smoke by civic-minded groups. They say that smoke filters out the health-giving ultra-violet rays of the sun, soils streets, buildings and clothing, increases the difficulties of housekeeping, makes life less pleasant. In all this they are absolutely right. They say that the smoke nuisance can and should be eliminated by law. In this they are partly right.

Engineers will grant that almost any coal can be burned without black smoke, given correctly designed equipment and a wide-awake operator. They will grant that the smoke situation can be tremendously improved by careful checking of new installations and by better operation of old equipment.

On the other hand, power men know that it is not economically or humanly possible to force immediate modernization of all industrial combustion equipment that is just naturally "smoky". They see, also, that early elimination of millions of sooty domestic stacks (the chief offenders in soft-coal regions) is an utter impossibility.

Neither laws nor education can banish smoke in this decade. The immediate practical objective then, must be smoke *reduction*, not smoke *elimination*.

Smoke abatement has several aspects, which must not be confused. One is scientific research, using all the gadgets of the scientist and statistician. By such means we shall gradually learn which types of stack discharge do the most harm and thus know where to focus future attacks.

Another problem is the present-day job of drafting and operating workable smoke ordinances. Here simplicity is the key to success; too much science will bog down the program with red tape and ruinous costs.

A case in point is the pressure, in some localities, to discard the Ringelmann chart and other simple visual tests of smoke violation. Because the visual test is admittedly "unscientific", also unfair to plants with large-diameter stacks and those burning large amounts of coal, some engineers say that smoke violations should be tested by the solids emitted, preferably expressed as a fraction of the total coal burned.

This seems fair enough. Unfortunately it is completely unworkable for about 98% of the total stacks. If the smoking laundry, hotel or small industrial can't be cited for smoke violation except on the evidence of actual measurement of solids emitted, the smoke inspector might as well shut up his office and play golf.

Both experience and common sense show that the spotting of violations among the hundreds of small industrial and institutional stacks must be made about as simple as buying a loaf of bread. For all such plants the ordinance must be so written that rule-of-thumb visual evidence will stand in court, if need be.

How, then, protect the big plant against unfair application of the "dense-smoke" test to its actual conditions. We can see no practical means of relief other than to insert in the law an alternative optional standard for the few big plants that burn more than a specified tonnage of coal per year. The ordinance might permit these plants to base their smoke performance on the average weight of solids emitted per ton of coal burned, if they are prepared to assume the costs of the necessary elaborate measurements.

It may be argued that all plants should be treated alike, that sauce for the goose is sauce for the gander. To which the answer is that practical men don't hunt fleas with a rifle, or lions with a flit gun.

Small Steam-Pressure Increase

New 275-lb cross-drum boiler and exhaust-heating turbine-generator serve higher steam and electric loads at much lower cost. New well system slashes water bill in half

By R H SOGARD
Supervising Engineer
University of Missouri

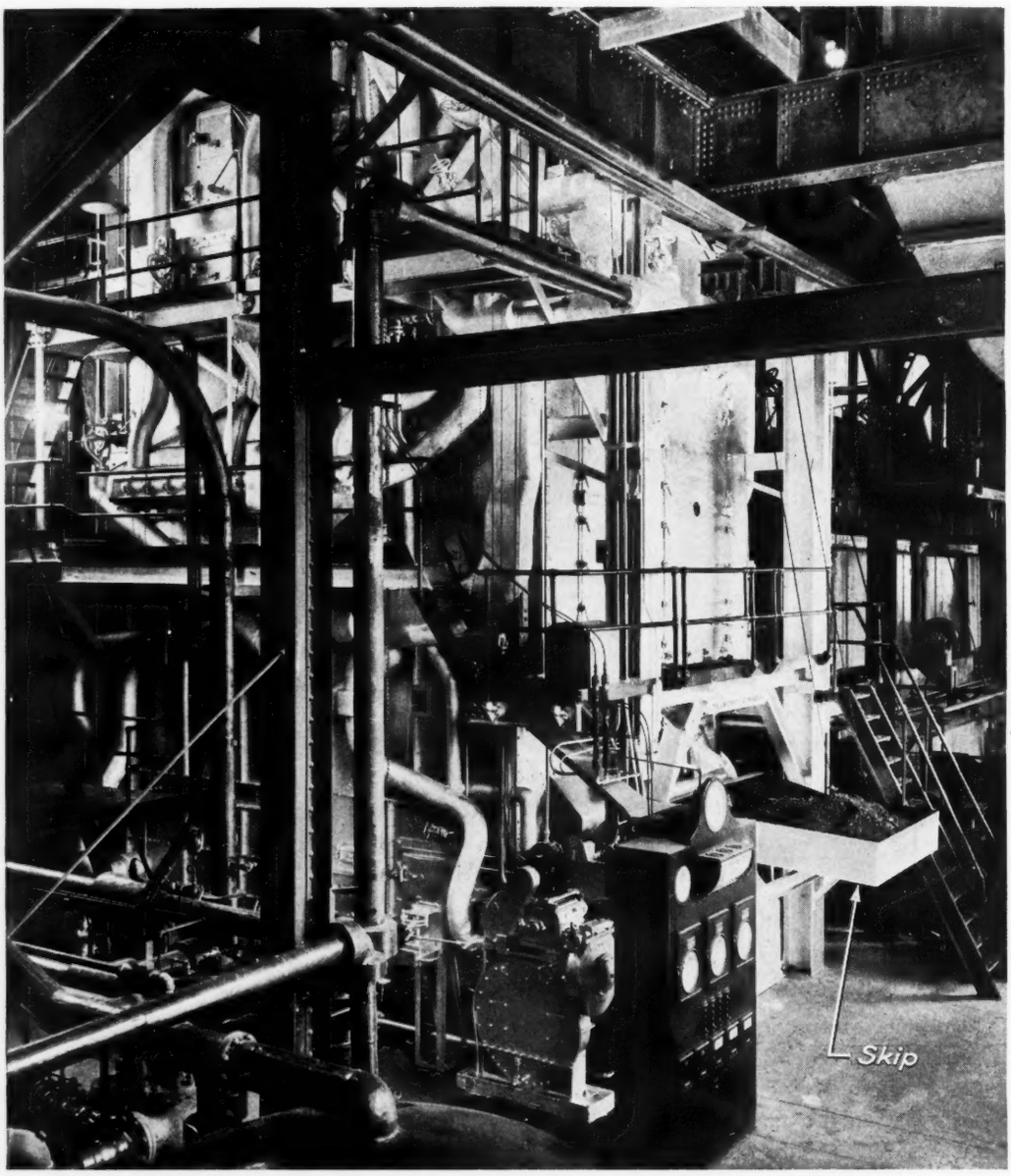


Fig. 1—New 50,000-lb-per-hr, 275-lb, 600-F boiler is fired by traveling-grate stoker

AN EXTENSIVE BUILDING program at the University of Missouri, Columbia, Mo., begun in 1936 and now nearing completion, increased water requirements 30%, heating 35%, and connected electrical load 41%. The principal obstacle to economy in the already well-loaded power plant was a 50-lb pressure heating system and only 150-lb boiler pressure. This combination prohibited the use of exhaust from electric generation for heating.

Fortunately, a special appropriation became available for installation of a high-pressure boiler and an exhaust-heating turbine-generator large enough for the base steam and electric loads, and for a new water supply. Studies were made based on turbine manufacturers' design data and on estimated load curves. These indicated that, for a 750-kw turbine and 70-lb exhaust pressure, a throttle pressure of 265 lb was high enough, considering the greater cost of boiler and auxiliaries for a higher steam pressure.

Because of space limitations for the

Cuts Coal Cost $15,000 a Year

needed steam capacity of 50,000 lb per hr and because of lower first cost, a cross-drum boiler was selected. For a small plant burning washed Missouri coal with 9% ash and 12,000 Btu heating value, at $2.50 per ton, supplying a relatively steady steam load, we felt that a forced-draft travelling-grate stoker was the logical fuel-burning equipment. An air heater was added for flue-gas heat recovery. Other boiler auxiliaries more or less fitted in with existing plant equipment. Coal-handling involved extension of an overhead parabolic bunker and weigh-larry track. A track and car system in the basement for ash handling was also extended.

The boiler room had space for the new steam-generating unit, but it had to be shoe-horned in between two roof trusses 17 ft apart. The roof between these two trusses was raised about 10 ft to accommodate the fans and air heater, Fig. 2. As the coal-larry spout could not be made to come within 5 ft of the stoker hopper on the new unit, it was necessary to add the skip, visible in Fig. 1. The skip is raised by a 2-drum overhead electric hoist.

Turbine-Generator

A non-condensing turbine-generator was selected for several reasons: Some use of 50-lb steam by laboratories and hospitals occurs the year round. Circulating water of 22 grains-per-gallon-hardness rules out a simple surface condenser system. Since turbine-exhaust pressure can be increased to 70 lb, it can be used to top the present condensing units. The foundation for the new unit was placed on the existing 1000-lb-per-sq-ft turbine-room floor, with some structural steel reinforcing beneath.

With the installation of the 275-lb boiler and turbine, the situation became such that four separate pressures would be maintained in different steam headers in the plant: 275 lb at 600 F for the new turbine; 150 lb from the older boilers for the present condensing units, 50 lb to the heating system, and 5 lb from various sources for feedwater heating, Fig. 4. A connection from the 275-lb header to the existing 150-lb header, made through a reducer-desuperheater, is large enough to handle the entire output from the new boiler. Thus, the 150-lb header is supplied either from the 275-lb header or from the older boilers.

Between the 150-lb header and the

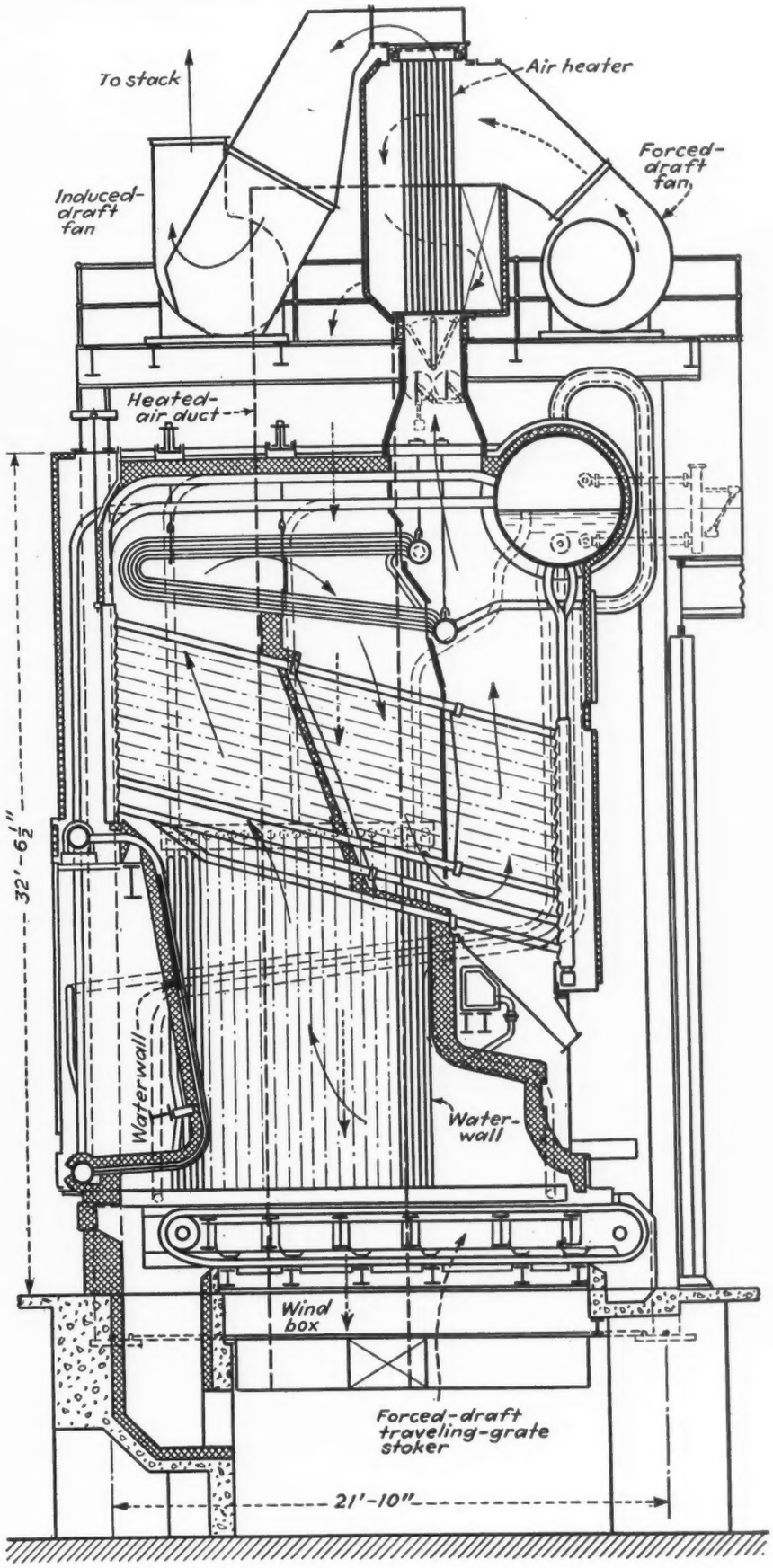


Fig. 2—Cross section of boiler showing fans, air heater and water walls

50-lb heating header (really 30 to 70 lb, according to heating-system demand) are 3 reducing valves: one 6 in., one 4 in. and one 2 in. The 50-lb header is supplied from the high-pressure-turbine exhaust, with the reducing valves in parallel to make up deficiencies. Feedwater-heating requirements at 5 lb are met by extraction from the older 150-lb turbines and exhaust from steam-driven pumps. The 275-to-150-lb reducer-desuperheater station may be seen in Fig. 3 on the gallery above the new turbine.

Because of cramped building space, overhead installation of high-pressure steam piping in the turbine room could not be avoided. Putting in standby reducing-valve connections to the 150-lb, 50-lb, and 5-lb headers required quite a layout of safety valves on those headers, as well as a 6-in. safety valve on the high-pressure turbine exhaust, ahead of the exhaust-gate valve. The turbine-exhaust safety valve early proved its worth when a connection sheared in the exhaust-gate-valve remote control, causing this valve to stay closed when it was supposed to open.

Feedwater System

Feedwater consists of building-heating returns and necessary make-up. The latter is 22-grain well water treated in a hot process lime-soda softener. Make-up had been fairly high when the heating load was small, as condensate from the older turbines was lost in their jet condensers. In order to operate the high-pressure boiler and turbine when heating requirements are small, a special but inexpensive surface condenser was built. Exhaust steam flows inside the tubes and the tubes are submerged in the 16- by 40-ft basin of an existing cooling tower, Fig. 4. This condenser is operated at atmospheric pressure solely for condensate recovery at certain times of the year.

By reducing make-up and exercising close control over feedwater treatment (testing once every watch), boiler water has been held at zero hardness and reasonable concentration. An additional help in reducing any carryover is the 60-in. inside diameter boiler drum.

A steam-flow-air-flow meter, steam-pressure and temperature recorders, a 10-point draft gage connected into an equal number of points in the draft system, air-heater temperature recorder and other meters and automatic combustion control make possible operation under practical test conditions at all times.

Previously, the University water-supply consisted of 2 deep wells (1 drilled in 1893, the other in 1910) pumped by air lift. These totalled 250 gpm and dis-

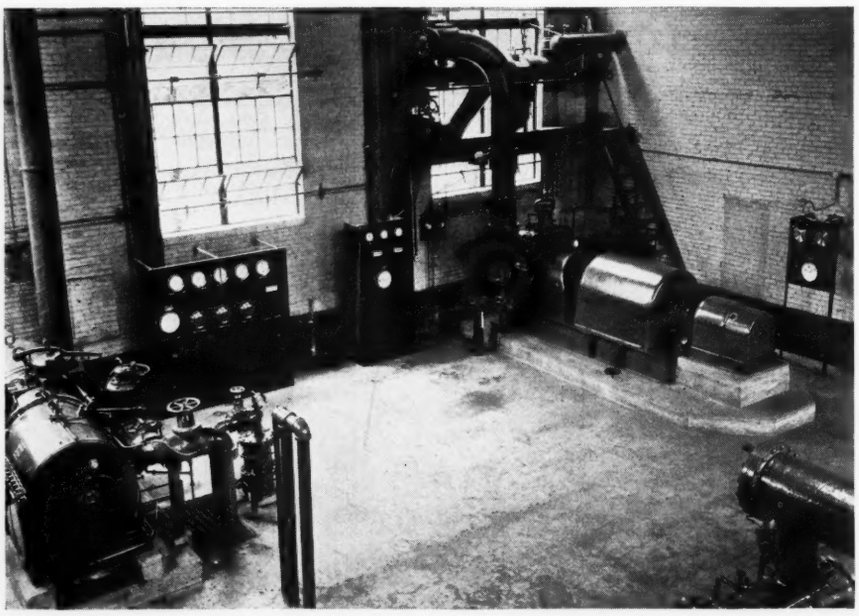


Fig. 3—275-to-150-lb desuperheating station above new turbine-generator

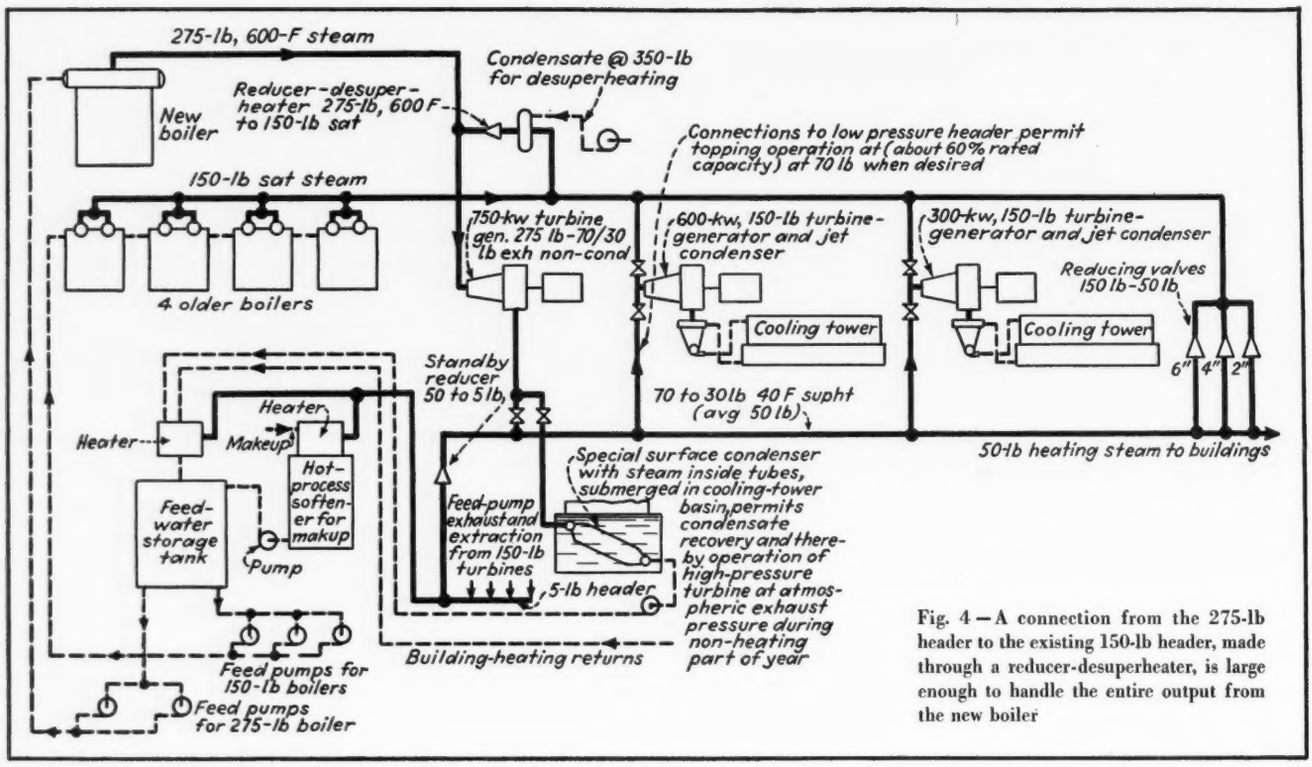

275-lb, 600-F steam
Condensate @ 350-lb for desuperheating
Reducer-desuper-heater 275-lb, 600 F to 150-lb sat
New boiler
Connections to low pressure header permit topping operation at (about 60% rated capacity) at 70 lb when desired
150-lb sat steam
750-kw turbine gen. 275 lb-70/30 lb exh non-cond
600-kw, 150-lb turbine-generator and jet condenser
300-kw, 150-lb turbine-generator and jet condenser
Reducing valves 150 lb-50 lb
4 older boilers
Cooling tower
Cooling tower
6" 4" 2"
Standby reducer 50 to 5 lb
70 to 30 lb 40 F supht (avg 50 lb)
Heater
Heater
Makeup
Hot-process softener for makup
Feed-water storage tank
Pump
Special surface condenser with steam inside tubes, submerged in cooling-tower basin, permits condensate recovery and thereby operation of high-pressure turbine at atmospheric exhaust pressure during non-heating part of year
Feed-pump exhaust and extraction from 150-lb turbines
5-lb header
50-lb heating steam to buildings
Building-heating returns
Feed pumps for 150-lb boilers
Feed pumps for 275-lb boiler

Fig. 4—A connection from the 275-lb header to the existing 150-lb header, made through a reducer-desuperheater, is large enough to handle the entire output from the new boiler

Principal Power-Plant Equipment

UNIVERSITY OF MISSOURI, 1938 EXTENSION

Steam-Generating Equipment:

Boiler, cross-drum type, and setting.....Babcock & Wilcox Co
Heating surface, 5035 sq ft; rated max continuous steaming capacity, 50,000 lb per hr; working pressure, 275 lb per sq in.; total steam temp, 600 F; furnace volume, 1600 cu ft; max Btu liberated per hr per cu ft of furnace volume, 44,700
Waterwalls, 2 side and rear, partially studded, 420 sq ft total surface .....Babcock & Wilcox Co
Superheater, convection, 1319 sq ft.....Babcock & Wilcox Co
Air heater, tubular, 2060 sq ft.....Babcock & Wilcox Co
Soot blowers .....Diamond Power Specialty Corp
Water columns .....Reliance Gauge Column Co
Breechings .....Camp & Luthy

Combustion Equipment:

Automatic combustion control.....Hays Corp
Stoker, forced-draft, traveling-grate.....Babcock & Wilcox Co
142.5 sq ft effective grate area, 275-F combustion air
Variable-speed transmission on stoker.....Reeves Pulley Co
Stoker skip hoist.....Robbins & Myers Inc
Forced-draft fan, 16,800 cfm.....B F Sturtevant Co
F-D-fan motor, squirrel cage, 20 hp.....Westinghouse Elect & Mfg Co
Induced-draft fan, 35,900 cfm, 510 F.....B F Sturtevant Co
I-D-fan motor, squirrel cage, 50 hp.....Westinghouse Elect & Mfg Co

Control, Valves and Desuperheater:

Safety valves.....Crosby Steam Gage & Valve Co
Blowoff valves.....Yarnall-Waring Co
Non-return valves.....Crane Co
High-pressure valves.....Edward Valve & Mfg Co; Chapman Valve Mfg Co
Low-pressure valves.....Chapman Valve Mfg Co
Atmospheric relief valves.....Manning, Maxwell & Moore, Inc
Reducing valves.....Fisher Governor Co; Mason-Neilan Regulator Co; Boylston Steam Specialty Co
Piping fabricator.....Midwest Piping & Supply Co
Piping erector.....American Power Piping Corp
Pipe heat insulation.....Kansas City Insulation Co; Keasbey & Mattison Co
Desuperheater, from 275 to 150 lb.....Swartwout Co
Desuperheater feed pumps.....Ingersoll-Rand Co
Traps .....Armstrong Machine Works

Feedwater Equipment:

Feed pumps, 2, each 125 gpm, 375 lb per sq in.....Ingersoll-Rand Co
One driven by 50-hp General Electric turbine, other by 50-hp General Electric squirrel-cage motor
Feed-pump governors.....Fisher Governor Co
Feedwater regulator.....Bailey Meter Co
Feedwater treatment.....Cochrane Corp
Continuous blowdown and heat exchanger.....Henszey Co

Metering Equipment:

Meter and control board.....Bailey Meter Co
Steam-flow—air-flow meter.....Bailey Meter Co
Steam- and water-pressure recorders.....Bailey Meter Co
Temperature recorders.....Bailey Meter Co
Ten-point draft gage.....Bailey Meter Co
Turbine throttle and exhaust press., temp recorder.....Bailey Meter Co
Desuperheater press., temp recorder.....Bailey Meter Co
Indicating pressure gages.....Crosby Steam Gage & Valve Co
Turbine panel load meter and tachometer.....General Electric Co

Electric Generating Equipment:

Turbine-generator .....General Electric Co
750-kw, 3600-rpm, non-condensing turbine; throttle steam condition 265 lb, 600 F; exhaust 30 to 70 lb. Generator 938 kva, 0.80 pf, 3 phase, 60 cycle, 2300 to 4100 volts. Direct-driven exciter, 15 kw, 125 volts, compound-wound
Generator air cooler.....General Electric Co
Oil cooler.....General Electric Co
Switchboard, meters and oil switches.....General Electric Co
Frequency recorder and controller.....Leeds & Northrup Co
Condensate cooling towers for coolers.....Lillie-Hoffman Co
Condensate circulating pumps.....Ingersoll-Rand Co

Water Works:

Deep wells and pumps.....Layne-Western Co
Two rock wells 1200 ft deep. Two Layne-Bowler vertical turbine pumps set at 400 ft, rated 500 gpm each, 20-lb discharge pressure at surface.
Pump drives, two 75-hp, 2300-volt, 1160-rpm motors..General Electric Co
Service pump, 500 gpm, 80-lb discharge pressure.....Ingersoll-Rand Co
Service pumps, five, 300 gpm, 80-lb discharge pressure..Dayton-Dowd Co
Water flowmeters and recording pressure gages.....Bailey Meter Co
Indicating pressure gages and thermometers.....Foxboro Co
Two 500,000-gal underground concrete reservoirs.....University forces

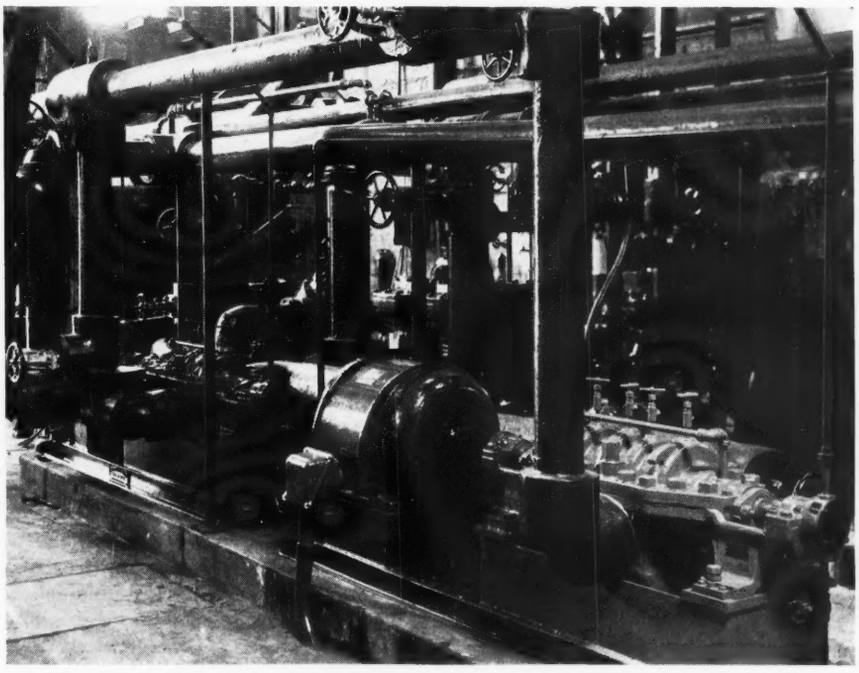


Fig. 5—Two 125-gpm boiler-feed pumps—one motor and one turbine driven

charged into a 100,000-gal open reservoir. It had become necessary to purchase about 20% of the annual water requirements. Cost of pumped water was high because of air-lift pumping with a non-condensing steam-driven air compressor.

After considerable study, we arrived at a plan for two new deep wells, spaced widely to prevent interference: one at the west end of the water-distribution system and the other at the east end, about a mile apart. At each location, a 500,000-gal. underground reservoir was built. To each reservoir was attached a concrete pumphouse, placed partially underground.

The pumphouse floor is set slightly below the reservoir bottom so that service-pump suctions are under pressure at all times and priming is eliminated. Each pumphouse accommodates the motor and head of a deepwell pump and three service pumps for delivery to the mains, with instruments and control equipment.

Deep wells were drilled at specified points on the sites of the pump-houses, before the latter were built. Each well was drilled in solid rock to 450 ft, 15 in. in diameter, at which point a ¾-in. cast-iron casing 12.5 in. inside diameter was set and sealed tight with concrete at the bottom. After the seal had set, drilling was continued with a 10-in. diameter hole to 1200 ft. Into each well was set at 400-ft depth a 15-stage turbine-type deepwell pump. Although the wells were rated at 500 gpm each, continuous pumping shows a capacity of 670 gpm from one and 800 gpm from the other.

Although the new installation has been in operation less than six months, a preliminary check on operating results shows that anticipated savings of $15,000 per year in coal will be more than reached. Results obtained during a check period from November 10 to December 15, 1939, indicate that even though 31.8% more power was generated than in the same period of 1938, coal cost was $2575, or 37.7%, less in 1939. Water costs are estimated at 5 cents per 1000 gal, compared to the previous figure of 11 cents.

*With 12,000 tons of refrigeration for air conditioning installed in Washington's government buildings, and more on the way, engineers and operators concentrate on safe operation**

Eliminating Refrigeration Hazards

By CHARLES A PETERS

Buildings Mgr, Public Bldgs Administration, Federal Works Agency

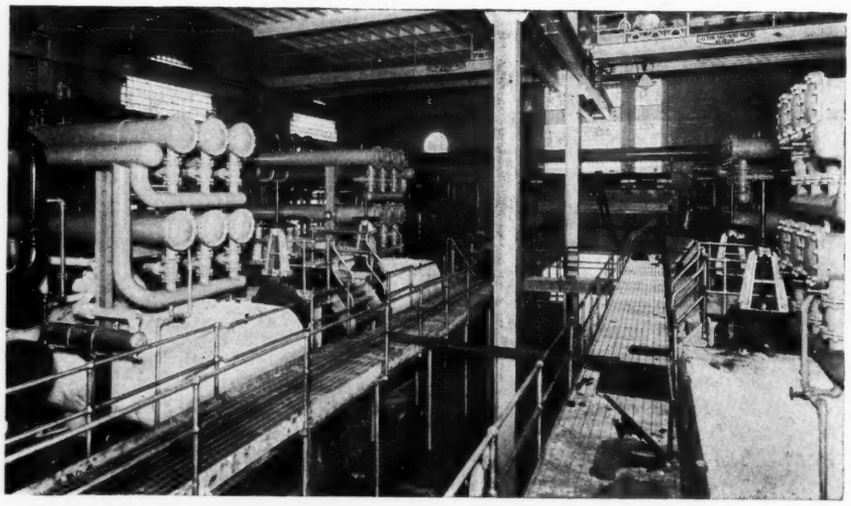
IN ITS JOB of maintaining and operating the majority of the Government Office Buildings in Washington, D. C., the Public Buildings Administration of the Federal Works Agency is vitally interested in refrigeration, since more than 12,000 tons are required for air conditioning and chilled-water systems, experimental laboratories, etc. As a result, one of our major problems is the safe maintenance and operation of this equipment.

Today's air conditioning involves installation of large mechanical refrigeration units in office buildings, department stores, theatres, etc. Consequently, a serious refrigeration accident might result in loss of life through actual injury or panic. These conditions produced new and improved equipment types, incorporating in their basic design features making them safely usable, with reasonable precautions, in buildings housing large numbers of people. Expanding use of air conditioning will undoubtedly further this trend to greater safety.

Earlier Installations

Some of the earlier air-conditioning installations in Washington office buildings employed ammonia equipment. Realizing the potential hazard involved in such an arrangement, we have taken special precautions to prevent any accidents. In more recent buildings, non-toxic and non-inflammable refrigerants supply the 12,000 tons of air conditioning, and new buildings will substantially increase this tonnage.

There have been no serious accidents in the units in any of the government buildings to date, due, I believe, to careful planning and installation, and to operation by a trained personnel that knows the equipment and how to keep it in perfect condition.



Refrigeration equipment at Capitol power plant, Washington, D. C.

The major potential hazards which go with the use of refrigerating equipment can be divided into six headings: (1) injuries due to use of toxic or irritating refrigerants, (2) fire or explosion due to escaping refrigerant, (3) mechanical failure of moving parts such as flywheels, pulleys, rotors, crankshafts, etc, (4) failure of compressors or other equipment, due to excessive pressures, (5) failure of condensers, coolers, or other equipment, due to freezing, (6) injuries to personnel due to contact with moving machinery or with live electrical equipment. The list, of course, only covers hazards of the engine room, though obviously the effect of such accidents might spread far beyond the engine room.

Two possible causes of injury grow out of use of toxic or irritating refrigerants. An employee may be continuously exposed to mild concentrations of a toxic or irritating gas, or suddenly exposed to a high concentration of such gas. Use of ammonia, sulphur dioxide, and methyl chloride, among others, involves these hazards.

Further hazards lie in the possibility of panic among building occupants in the event of sudden leakage of gas. Obviously, the odor of some refrigerants is disagreeable and the choking, blinding effect would startle persons unfamiliar with this sensation, so that a panic would almost certainly follow escape of a large quantity of gas into offices where people are working.

Government equipment has been designed to eliminate to the fullest extent the possibility of such occurrence. Where ammonia gas is used, as in older installations, the equipment is housed in separate buildings where possible, or in separate rooms, adequately vented and cut off from other areas.

Our greatest step forward in this connection has been, we feel, the choice of non-toxic, non-irritating, and non-inflammable refrigerants such as Freon-

* Condensation of an address delivered before the Refrigeration Section, National Safety Council, Atlantic City, N. J., October 16, 1939.

11 and Freon-12. These refrigerants can escape, and have escaped, in fairly large quantities without objectionable odor or danger or inconvenience to building occupants. Both are heavy and will lie at the floor level. A space which is likely to be heavily saturated with Freon should be well ventilated and the air circulated rapidly.

Turning next to the hazard of fire or explosion, there are records of a number of serious explosions in plants using ammonia as refrigerant. In most of our plants this hazard has been eliminated by use of non-inflammable refrigerants such as the Freons. These will not support combustion and actually have a blanketing, smothering effect on a fire. Freon can be broken down by a very hot flame, however, and a fire of serious proportions in an engine room could disintegrate the refrigerant, producing a potentially serious situation. I believe we eliminate this danger by seeing that our engine rooms contain little if any combustible material, so that it would be practically impossible for a fire to occur which would have a temperature high enough to break down the Freon.

Danger of mechanical failure of moving parts lay particularly in old equipment where the source of power was often a steam engine or a belt drive from a lineshaft. We believe we have eliminated this hazard by electric drive with synchronous or induction motors which cannot rotate faster than synchronous speed. Most compressors are direct connected to motors or driven through a fixed set of gears. A runaway is unlikely and if any rotor, wheel, or pulley were to burst it would do so at some speed equal to or below design speed.

This positive limit on top speed also greatly reduces danger of failure of compressors or other equipment from excessive pressures, since overspeeding has often caused excessive pressures. In addition, safety valves protect all our pressure equipment, on both high- and low-pressure sides. All vessels, pipe fittings, joints, etc, are built sufficiently strong and thoroughly tested, before installation, in accordance with ASME Code for Unfired Pressure Vessels.

Protective Devices

Installation of electrical and thermostatic protective devices to stop equipment before conditions become unsafe eliminates possibility of failure of condensers, coolers, or other equipment. Use of standard approved guards for moving parts, use of guard rails where necessary and all other features of good protective practice reduce risk of injury from moving parts. Proper grounding of motors, and use of fully-enclosed switchboards and control boards gives protection against usual electrical hazards.

Undoubtedly, adoption of these safety measures makes our plants a great deal safer than those of a few years ago. However, all this has not been gained without some sacrifice. For instance, some types of centrifugal machines using low-pressure refrigerants, such as Freon-11, run noisy and the high speed is disturbing to building occupants and operating personnel. Again, it should be mentioned that cost of Freon runs higher than for ammonia to produce the same amount of refrigeration.

With all possible precautions and automatic controls, we still feel that continued satisfactory and safe operation requires a skilled force of intelligent well-trained operating engineers. All our operators meet Civil Service Commission requirements for such positions. In addition, they receive training in the work they have to perform and are supervised in this work by both practically and technically trained men. This office conducts a continuous in-service training school, in which the men learn the practical and technical aspects of operating refrigeration equipment, together with the necessary safety features which are essential to the satisfactory operation of refrigeration equipment.

✦ ✦ ✦

Buying a Diesel?

If you are, you want an engine that will produce the needed power for the least possible cost for the longest time. Here are some things to think about before you buy

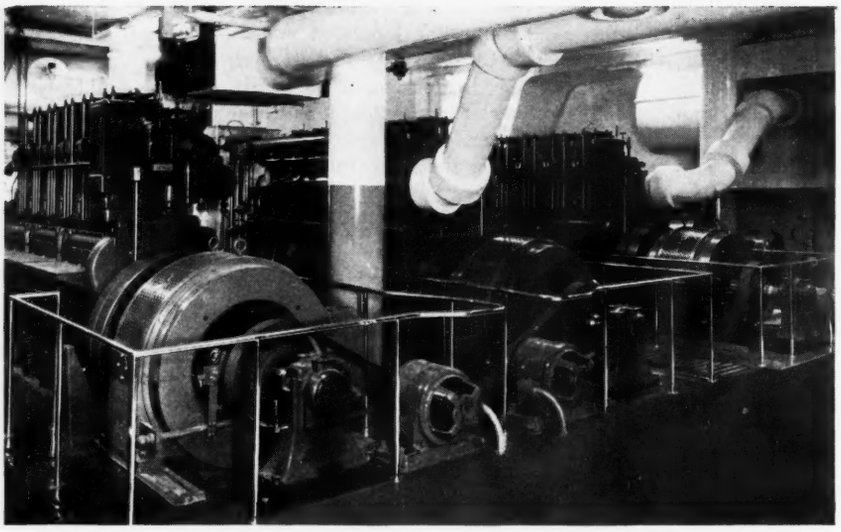
By GLENN C BOYER
Associate Engineer, Burns & McDonnell Engineering Co

WHAT DO YOU LOOK FOR when you buy a diesel engine? Well, what does a horse trader look for when he buys a horse? According to all accounts, he looks first into the horse's mouth. He is, of course, trying to check the horse's age. This isn't as far from buying a diesel as you might think, because age enters that question too. Not the age of the engine, in this case, but the age of the maker forms the important point.

It is well known that much of the design of a diesel engine is a matter of empirical knowledge gained from operation and tests of previous designs. The more years of experience any engine manufacturer possesses, the better the product he should have to offer, and the better chance the buyer has to study and analyze the performance of his engines. A maker's experience shouldn't be the only factor considered, or new manufacturers wouldn't ever get started, but where other things are more or less equal such experience should count.

With this idea of age and experience as a starting point, let's consider some of the other elements affecting the selection of an engine. The elements which builder, purchaser and operator should consider are piston speed, rotative speed, brake mean effective pressure, type of fuel injection and engine cooling. Many other factors, such as stroke cycle, method of scavenging in 2-stroke-cycle engines, or structural design of engine parts may be of paramount importance in some instances. In general, however, the purchaser or operator is primarily interested in those elements of engine design which will produce for him the amount of power required at the least cost and over the longest period of time.

In this respect, I have contended for years that specifications for the purchase of a diesel engine should set forth the performance conditions the engine must meet and should not attempt to prescribe how the manufacturer should build his engine. This is somewhat hard to do, particularly when a purchaser insists upon setting up certain rigid requirements which may prove ideal on one make of engine but not so good on another. The fact that there are so many successful designs of engines available today seems to prove that there are many ways of



These diesels power a large New York department store

burning oil on the diesel cycle and converting the oil's chemical energy to useful work.

The difficulty confronting the engineer when he makes his specifications too rigid can be illustrated by considering rotative speeds of engines for central-station work. There are six possible synchronous speeds starting at 150 rpm and less than 200 rpm, six speeds starting at 200 rpm and less than 300 rpm and 4 speeds from 300 to 400 rpm, inclusive. If, for example, the engineer says the engine must run at 257 rpm, he automatically eliminates 5 other possible speeds in the same range, all of which would probably prove as reliable and economical as the speed specified. By barring some builders' standard engines, or requiring design alterations, the purchaser runs up the cost.

Likewise, setting up a definite brake mean effective pressure leads to difficulties. For example, brake mean effective pressures of present-day 2-stroke-cycle engines range from 33 to 68 lb per sq in., while those for 4-stroke-cycle engines range from 64 to 82 lb. In considering the effect of brake mean effective pressure, the buyer must take care to allow for the general engine design, and especially methods of cooling both piston and cylinder. These things must be taken into account in order to determine correctly whether or not an engine will operate safely for long periods at the brake mean effective pressure for which it is rated.

Here is another question which can be answered best through the accumulation of field experience. I have heard competent engineers testify under oath that a particular design of engine could not possibly run for any length of time when the brake mean effective pressure exceeded a certain value. After hearing these opinions, I have gone into the engine factory and tested the design under conditions and loads which produced pressures running 20-30% above those claimed to be injurious, without apparent ill-effect as far as the engine was concerned. Furthermore, I have followed the operating experience of these engines over a period of time long enough to prove that while engineers may testify that a thing cannot be done, the final proof lies in performance.

Considerable difference of opinion exists about piston speed, as can be seen from the fact that speeds for engines in central-station service vary from 650 to 1114 fpm. A majority of the engine builders employ piston speeds over 900 fpm, and speeds of 1000-1100 fpm are quite common. It has been my experience, substantiated by many others, that high rotative speed will have more effect on engine life than high piston speed.

Fuels and Injectors

The question of fuels and injection systems worries many diesel buyers. And rightly so, for many operators have been needlessly hampered in fuel purchasing by engines fitted to handle only a limited range of fuels. Today it is more important than ever to get this matter straightened out, as new refining methods and shifting economic factors cause the fuel picture to change rapidly.

The one safe conclusion seems to be that fuel versatility in an engine is highly desirable. The wise engineer will specify that the engine must handle fuel of as poor a grade as is likely to prove economical in the area where the plant is to be built. For very low grade fuels, this would once have meant air injection, but progress in design of mechanical-injection systems has considerably broadened the range of fuels that can be handled. If the engine bought can burn a wide variety of fuels, then choice of fuel in later years can depend entirely on relative fuel costs and comparative handling and maintenance costs.

Many of the factors to be considered in selecting a diesel are more or less related. This is no more apparent than in the case of brake mean effective pressure and engine cooling. In a given cylinder, the heat release per unit of volume runs roughly proportional to the brake mean effective pressure. Thus, if a 16x20-in. cylinder operates at 50 lb per sq in. and then at 70 lb, the heat release at the higher pressure exceeds that at the lower pressure by about 40%. To operate satisfactorily at the higher pressure, the design must provide a more thorough cooling system for both pistons and cylinder jackets than would be needed for operation at the lower pressure.

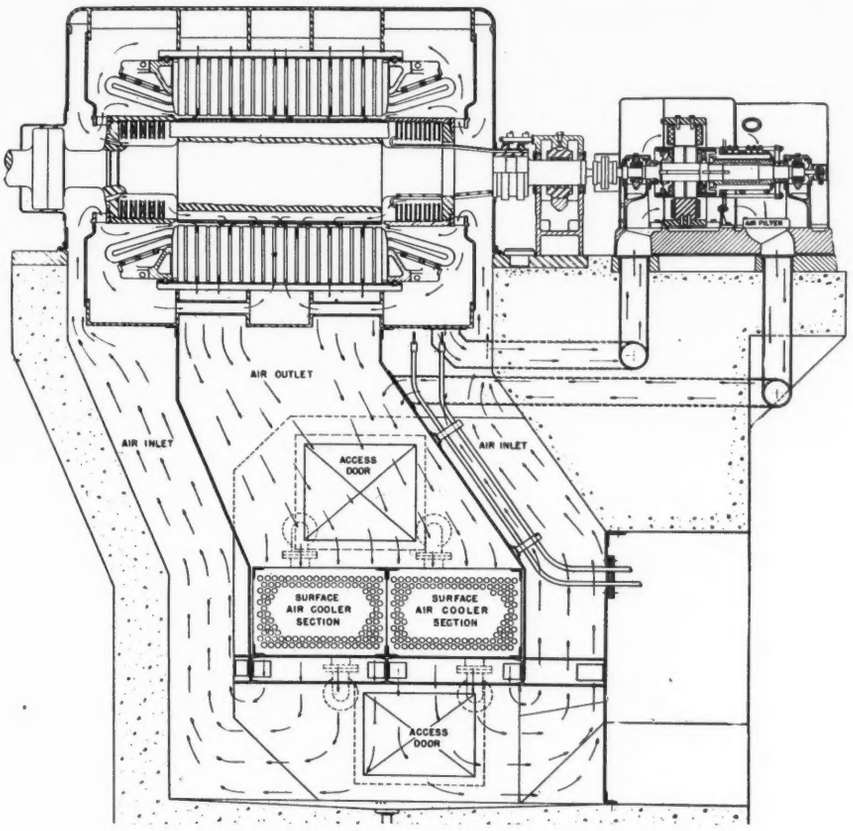
Therefore, we find engines operating with brake mep's of 30-40 lb can get along without piston cooling, depending entirely on jacket cooling to maintain safe operating temperatures. As mean effective pressures go up, it becomes necessary to cool the piston as well as the cylinder jacket. This brings another factor into consideration. Jacket cooling is universally accomplished by means of circulating water. Piston cooling can be handled by circulating either water or oil through the piston. Of the two methods, oil seems preferable, as a leak in the piston cooling system will not contaminate the lubricating oil in the crankcase.

The general arrangement of the cooling system on the engine should be simple and should assure that the cooling medium, be it water or oil, will get to the parts of the jacket and piston where it will do the most good. Here again, past experience is the best guide as to whether or not a particular cooling system actually cools.

LETTERS FROM A TURBINE SPECIALIST

No. 7—On Generator Air Coolers

By F S KOHL and D P HESLER
General Electric Company



Recirculating and surface-air-cooling arrangement

Dear Mr Specialist:

I've heard a lot about generator air coolers but nothing so far has convinced me that they are really an economically sound investment. Can you give me the inside story? Do they really earn their keep, or are they just another gadget to maintain? Anything you can tell me about them along these lines will certainly be appreciated.

Yours very truly,
Engineer

Dear Mr Engineer:

Generator air coolers have proven so valuable that seldom is a turbine-generator set rated 500 kw or larger installed without one. Air coolers are so widely accepted that they are often classed as a required accessory. Their use has been one of the most important single factors contributing to the remarkably low outage record of turbine-generators.

No doubt you are familiar with the usual cooler arrangement (see diagram). Ventilating air for the generator is continually recirculated within a closed system. The warm air discharged from the generator is cooled in passing over the finned surface of the cooler. Water is the cooling medium. The cool air is directed back to the generator.

Benefits of air coolers largely result from the fact that ventilation is secured with a closed and compact air system. The major advantage is that only clean air is passed through the generator. Dirt, soot, coal dust, and oil vapors which would tend to deteriorate the insulation of the windings, are almost entirely excluded. The life of the insulation is prolonged. Little, if any, time is required for cleaning the generator. Its "use factor" is increased, its maintenance decreased. Inspections, even after years of operation, often show the insulation of a generator with an air cooler to be almost as clean as it was the day it left the factory.

Another point—the generator fire hazard is reduced with the closed compact system. This point is an important one even though the occurrence of a generator fire is rare. Because of the limited volume of air in the system, little oxygen is available to support combustion. Open systems continually draw in new air resulting in a "forced draft" contributing to the intensity of a fire. With the closed system, the elimination of dirt and combustible deposits on the windings is an added factor in reducing this hazard.

If a generator were to be installed without an air cooler, a duct system of some kind or another would be required. These ducts would very likely be elaborate and expensive and would occupy a considerable amount of valuable space. A supply duct leading from a suitable source of air would be essential. A discharge duct, while not so essential, would be very desirable as otherwise the warm air would be released at a high velocity directly into the station. The resulting noise and overheating of the station, especially on a hot summer day, would be very objectionable.

On some large turbine-generator installations, condensate can be used as the cooling water for the air cooler. In this manner generator heat losses are recovered and transferred to the feedwater with consequent improvement in station economy.

These items are the major ones to consider, but there are others of secondary importance. For example, air coolers are available that can be mounted integral with the generator housing above the operating-floor level. Such an arrangement is an advantage where basement headroom is lacking.

Air coolers are not limited in their application to turbine-generators, but are used for cooling many types of electrical apparatus where the closed system of ventilation has advantages. Common applications are waterwheel generators, synchronous condensers, frequency-changer sets, and large motors of almost every type. In these applications, as in the case of turbine-generators, coolers help protect large investments by insuring maximum availability of equipment.

Sincerely yours,
Turbine Specialist

An operating engineer sets down the things he looks for and after to insure reliability

So You're Going to Put in a Centrifugal Pump

By VINCENT A R MINTER
Charleston, W. Va.

IF PART OF YOUR JOB is operating and maintaining centrifugal pumps, you will have had, or do have, occasion to be concerned about packing. Few installations, even in the simplest of services, are trouble-free in this respect. When leakage means loss of valuable product or results in an unsightly and sometimes hazardous condition, packing problems become mountainous.

Freedom from packing trouble is primarily a matter of pump design. This vital point cannot be overemphasized and it is one that is frequently overlooked by plant engineers, purchasing authorities and even, it would seem, by pump manufacturers themselves. By design I mean those elements which insure rigidity and proper alignment of pump parts. How often have you come across a mechanic feeding packing into a "bad actor" that on closer inspection proved to be suffering from an advanced case of shaft "wobblyitis," shroud-ring consumption or bearing decay? What we are interested in are design features that will minimize, if not eliminate, packing trouble.

Specifications

Let us assume that, for once, we are to have the say on the purchase of a virgin pump. The purchasing agent has loosened up and acceptance of the rock-bottom bid is not mandatory. Well, how are we going about our selection? First, we are going to write into our specifications a clause worded something like this:

"Each quotation shall be accompanied by a dimensioned cross-sectional view of the unit showing details of construction and listing the materials to be used in the various parts."

Secondly, we are going to be hard-boiled enough to toss out any quotation not received with such a drawing. None of those beautiful multicolor sections so dear to the heart of the salesman for us! Now, with the print in front of us, we are going to assure ourselves of the following:

1. Does the general arrangement and proportions of the unit indicate a well thought-out, rugged, balanced design?

2. Is the design compact enough to eliminate trouble from overhung rotating parts without necessitating use of an unduly large shaft?

3. Is the design such as to hold impeller and shaft assembly in both static and dynamic alignment? Are running clearances correct?

ISSUED BY_____
CHKD BY_____
APPRD BY_____
REVISED BY_____
" "_____
" "_____

THE "X" 'EM CO INC
PUMP DATA SHEET

SHEET____ OF____
ISSUED_____
REVISED_____
"_____
"_____
"_____

FACTORY IDENTIFICATION				
1. NAME				
2. NUMBER				
3. LOCATION				
4. INSTALLATION DATE				
5 PURCHASE ORDER NO				
MANUFACTURER'S DATA				
1. TYPE				
2. SERIAL NO				
3. DRAWING NO				
4. PARTS CHART				
5. FILE LOCATION				
SERVICE CONDITIONS				
1. LIQUID HANDLED				
2. CAPACITY — Gpm				
3. SUCTION HEAD — Ft				
4. SUCTION LIFT — Ft				
5. DISCHARGE HEAD, Ft				
6. OPER TEMP — F				
7. SPEED — Rpm				
8. CONTIN OR INTERMIT				
PACKING DATA				
1. END RINGS — No. & Code				
2. MAIN RINGS — No. & Code				
3. LUBRICATION — Yes! No!				
" Kind				
4. BACKWASH — Yes! No!				
" Kind				
5. INSPECTION SCHEDULE				
REMARKS				

Keep a record of pump data for ready reference on a form like this

4. Is the packing box adequate for packing-space length and accessibility? Can the gland be inadvertently cocked and cause damage to the shaft? Are the gland clearances correct?

5. Is that portion of the shaft passing through the packing box protected by a carefully finished, hardened sleeve?

6. Are the bearings in the pedestals adequate and are they protected against entry of all materials other than the proper lubricant?

7. Are the materials of construction suitable for the operating conditions and will they give long and corrosion-free service?

8. Is pump speed correct considered from the stand-point of efficiency and bearing life?

If you are able to answer each of these questions affirmatively in regard to a particular pump, you need not hesitate about buying it. You can do so knowing that basically you have a good pump and one in which any packing trouble that may occur will not be aggravated by mechanical defects.

A preliminary study of general design to obtain an over-all impression of what is offered is always the best approach to any purchasing problem. The experienced technical man senses unbalance in design, not always apparent from a study of separate parts. So give the general picture some thought before passing on to a study of details.

Compactness of design is desirable both from hydraulic and mechanical considerations. In this connection, the desirable design will have the impeller placed as closely to the bearing as practical. If this is done, an unduly large diameter shaft to prevent whipping will seldom be necessary. Frequently, pump manufacturers, for economic reasons, use the same casing for a range of capacities. If this is carried to extremes, the pump may lack compactness and should not be considered.

Impeller and shaft must stay in static and dynamic alignment. A careful study of this point and an insistence upon this being so will more than repay you in obtaining trouble-free packing. While the impeller load must be properly carried by bearings outside the pump casing, alignment will be greatly assisted by wear and shroud rings on each side of the impeller. A long, sturdy, close-fitting and removable bushing at the bottom of the packing box will also help alignment, at the same time making the packing more effective.

Running Clearances

As for running clearances, no hard-and-fast rule can be laid down. Experience must determine their magnitude; make them as small as operating conditions and materials of construction will allow. In the absence of definite personal operating experience, it is well to leave this point to the judgment of the pump manufacturer.

Inadequate packing boxes, inaccessibly located, are the rule rather than the exception on most makes of so-called standard pumps. If your service warrants it, and it usually will, select a unit having room for 5 to 6 rings of packing exclusive of lantern-ring space. Try to imagine the mechanic packing the pump and purchase one that will give him a break on accessibility. Look at the gland design. Can the mechanic inadvertently pull it up irregularly and thereby cause excessive wear on the shaft or sleeve? Many pumps are now equipped with 2-piece glands. These are to be recommended in that the follower, or cylindrical portion, cannot be cocked. Avoid a sloppy fit between shaft, gland and packing box. Reasonably close clearance between these parts will again make the packing more effective.

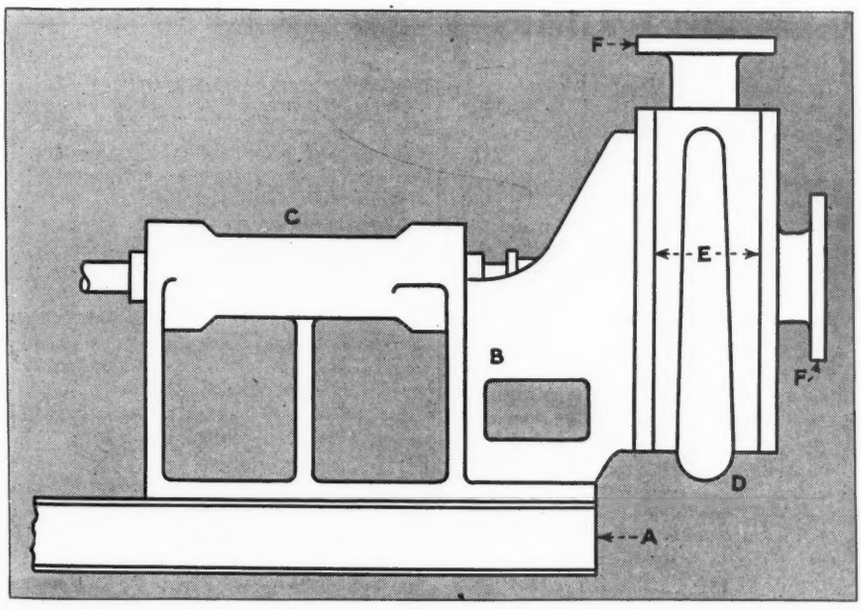
Regardless of pump type or service conditions, purchase a pump in which the packed portion of the shaft is protected by a sleeve. Study the retention of this sleeve on the shaft to make sure that leakage cannot occur between the sleeve and shaft. Means for removing the sleeve easily for maintenance or replacement must also be investigated. The sleeve itself must be carefully finished—both size and polish. Since the sleeve is one element that will bear the brunt of the wear, its surface must be hardened to the maximum, consistent with other physical properties.

Bearing Supports

To those of us who want dependability and maintenance-free performance, features which add the ultimate ½% efficiency mean nothing, but we can appreciate a rugged support-bearing structure. Much of the packing trouble on pumps can be traced to misalignment of bearings because of an inadequate frame structure and bearings. Insist upon generous bearings. Many engineers prefer anti-friction bearings. Several pump companies use double-row ball bearings at the pump end of the pedestal. Insofar as this design gives better support and alignment, its use is to be encouraged.

Look for adequate protection of bearings. Seals found on some pump-bearing pedestals are unsuitable for service in dirty or corrosive atmospheres. Hence frequent replacement of the bearings may be necessary. Some pump manufacturers are using modifications of the labyrinth seals now generally used on the better designs of electric motors. Such seals have been very effective in service.

Selection of proper materials for a given service is of primary importance. Yet, it is the one phase of the problem which many of us are poorly qualified



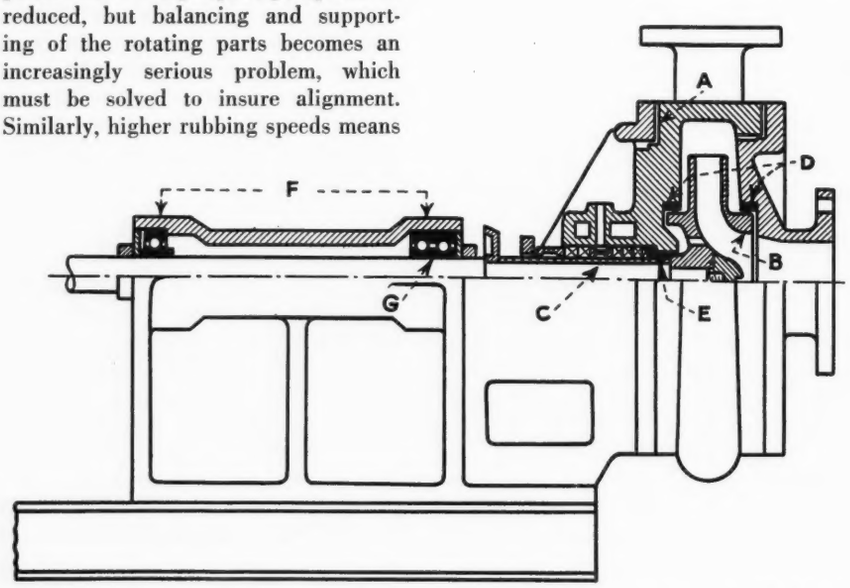
Rugged construction requires these features: *A*—Rigid continuous base for pump and drive unit. *B*—Strong compact pump pedestal. *C*—Long rigid bearing housing. *D*—Minimum overhang of pump head. *E*—Adequate flanged casing joint. *F*—Flanged suction and discharge nozzles

to answer. This, of course, does not apply with as much force to standard installations covered by adequate past experience as it does new applications beyond, perhaps, the explored boundary of materials. Our metallurgical friends, however, are constantly improving old metals and bringing out new ones so, that even in duplication of existing units, it is well to think in terms of materials of construction. New applications merit the deepest study to insure proper material selection.

Unless you are part of a large technical organization employing research talent capable of answering this problem, it is well, at this point, to take advantage of the wider experience of the pump companies and permit them to suggest desirable metal or combination of metals for your pump. Unique as your problem may appear to be, they, through their wide contact with pump users generally, may have encountered and satisfactorily solved a similar problem. Do not, however, abandon your use of independent judgment even here. You should consult the standards of the Hydraulic Institute which lists materials for pumps used in a very wide range of applications.

Remember that economic considerations should govern material selection. While first cost generally is not always the controlling factor, there is little point in purchasing an expensive unit unless its initial cost is more than balanced by elimination of outage time, parts replacement and routine maintenance. Conversely, if the unit is an important part of equipment used in a continuous process, purchase of a cheap pump requiring much maintenance will hardly prove to be a sound investment.

In my opinion, using high speeds to improve hydraulic conditions and reduce first cost has been adopted in some cases without consideration to the handicap added to the mechanical side. For equal head and capacity, the impeller size of a high-speed pump can be reduced, but balancing and supporting of the rotating parts becomes an increasingly serious problem, which must be solved to insure alignment. Similarly, higher rubbing speeds means greater friction on running parts such as impeller shrouds and wearing rings, bushings and packing, with resultant greater wear. It is well, therefore, to select the operating speed of a pump only after considering the balance between efficiency, compactness and first cost on one hand, with possibilities of increased maintenance on the other. Other things being equal, the pump with the moderate operating speed is the one generally preferred.



Pump alignment is essential to good operation, so look for these points: *A*—Machined interlocked pump-head parts. *B*—Balanced impeller design. *C*—Strong 1-piece shaft. *D*—Wearing rings to help guide impeller. *E*—Substantial bushing at end of packing box. *F*—Wide-spread bearings. *G*—Double-row anti-friction bearings

Exhaust Lines

By L N ROWLEY

Puzzled by mysterious explosions in tanks holding wartime stocks of gasoline, British authorities suspected sabotage but couldn't prove it, as the terrific blasts left no evidence behind. But when a kerosene tank blew, investigators found bubbles of gas rising from a layer of water at the tank bottom, on which the kerosene had been floating. Dr A C Thaysen, expert on generation of gas by bacteria, examined some of the sediment, found it contained a new kind of bacteria, able to live in kerosene. Fermenting into 10% ethane and 90% methane, the "bugs" caused the explosion. Dr Thaysen is practically sure a similar action accounts for the gasoline blasts.

Nothing I saw at Iron Fireman's Cleveland plant, during a swing through the Middle West in January, gave me a bigger kick than the way they make feed screws. Visitor's eyes pop as a specially-designed lathe nonchalantly wraps a 1x2-in. cold-rolled bar around a mandrel. The spiral is then welded to a cold-rolled rod to make the completed feed screw.

At the Bruce-Macbeth plant I watched them test one of their new engines with the "tank" cooling system. Designed to eliminate scale troubles and make jacket cleaning easy, the unit is arranged so that the cylinder barrels set in a steel tank, with open top, in which a constant water level is maintained by a draw-off pipe near the top. Incidentally, this construction gives the engine a sleek, streamlined look.

At the Heating and Ventilating Show in Cleveland there were some fascinating domestic gadgets. Figuring that most of us never get so much kick out of life as when we're tinkering around the house, I'm passing a few of the interesting things seen at the show, such as . . . a new thermostat with a dial on the side for easy adjustment of "burner-on" period . . . streamlined forced-flow hot-water heating systems, two of them with outdoor thermostats to regulate temperature of water continuously circulated in the system . . . a specially-designed window screen, claimed to cut sun heat by about 80% . . . a centralized, easy-to-operate venting system for hot-water heating plants . . . a high-efficiency heating system in which combustion products, plus excess water vapor to dilute condensation acids, circulate through radiators . . . a gas-fired year-around conditioner using absorption refrigeration.

In Milwaukee the doctor takes his own medicine—walking around the Nordberg plant I spotted a steam-engine and asked where it was going when finished. "Right here", was the answer, "we need some capacity in our own plant". Aside from this intramural activity, I noted particularly a large diesel unit for Bryan, Ohio.

Direct Solution for Pipe Capacity

Rational method of computing friction loss for fluids flowing in pipes takes out most of the guesswork in finding proper "friction factor". Graphical construction avoids trial and error

By Dr J R ZWICKL, *Worthington Pump & Machinery Corp, Harrison, N. J.*

THE FANNING FORMULA, Equation (1), computes directly the friction or head loss in straight pipes for any liquid (or gas provided the total pressure loss does not exceed 5–6% of the original absolute gas pressure). To use the formula, a friction factor, f, is needed and can be found from an experimentally determined curve, Fig. 1. To find the friction factor on this curve for a given flow in a certain size pipe, the Reynolds number (a numerical quantity that varies with pipe diameter, velocity, density and viscosity for a given fluid) is first calculated from Formula (2).

The primary purpose of this article is to present a direct method for calculating the *amount* of fluid that will pass through a certain pipe, also the *pipe diameter* needed for carrying a given fluid quantity with a specified head loss in both cases. The Fanning formula (1) cannot be used for these problems directly since the data needed for computing the Reynolds number are not given and a trial-and-error method is usually employed. Before discussing these, however, a clear understanding of the straight-forward head-loss calculation is necessary.

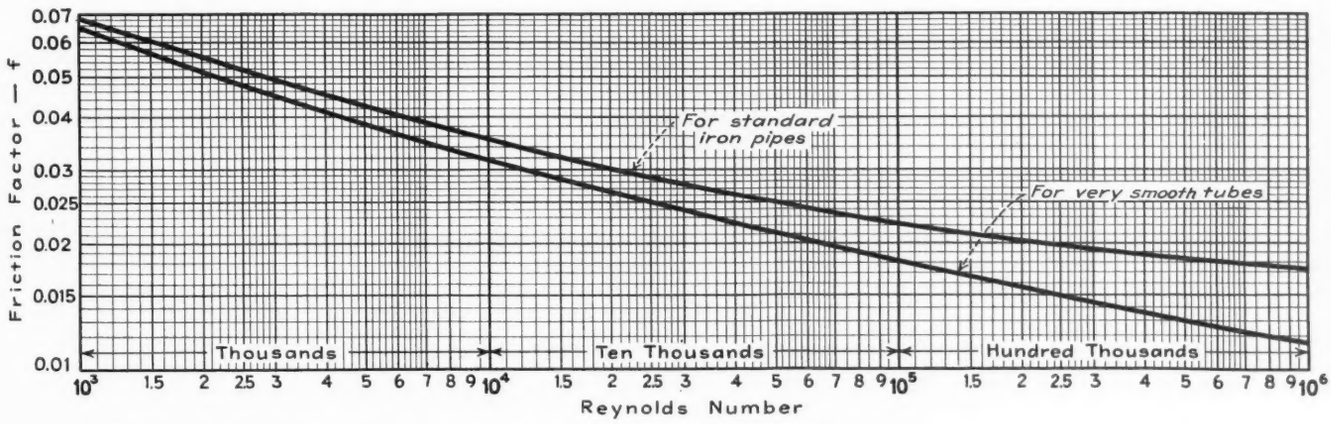


Fig. 1—Friction factor varies with velocity, pipe size, density and viscosity as expressed by Reynolds number

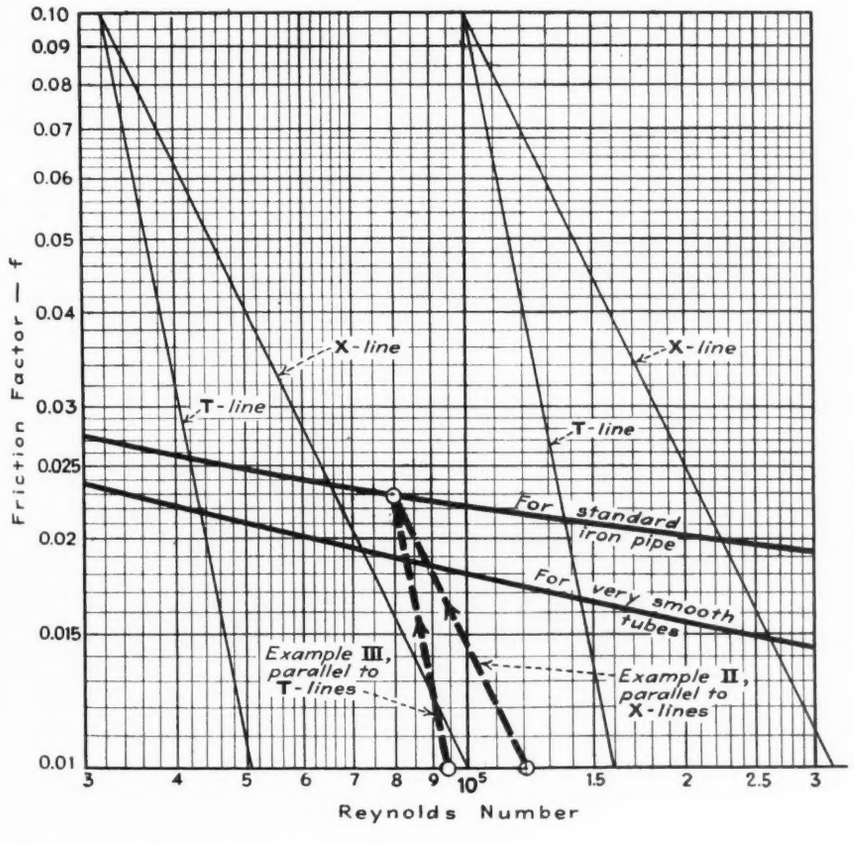


Fig. 2—Section of Fig. 1 with *X* and *T* lines drawn in. See Examples II and III on following page

Example I shows the complete calculation of an illustrative example. Wanted the head loss in 300 ft (equivalent length) of 4-in. standard iron pipe carrying 100 gpm of cold water; first calculate the Reynolds number from Formula (2) as 79,000. The corresponding friction factor from Fig. 1 is 0.023. Formula (1a) gives the head loss directly as 2.1 ft of water. This calculation can be performed in exactly the same manner for oil, steam, gas or any other fluid, employing, of course, the

EXAMPLE I

Calculate head loss in 300 ft of 4-in. standard iron pipe carrying 100 gpm of cold water. Using Equation 2:

$$R = \frac{4}{\pi} \times \frac{V}{d} \times \frac{S}{Z} = \frac{4 \times 0.223 \times 62.4}{3.14 \times \frac{1}{3} \times \frac{1}{1488}} = 79{,}000$$

$V = 100 \text{ gpm} \times 0.002228 = 0.223 \text{ cfs}$
$S = 62.4 \text{ lb per cu ft}$
$Z = 1 \text{ centipoise} \div 1488 = \frac{1}{1488} \text{ lb/ft sec}$
$d = 4 \text{ in.} \times \frac{1}{12} = \frac{1}{3} \text{ ft}$

From Fig. 1, $f = 0.023$

$$h = \left(\frac{4}{\pi}\right)^2 \times \frac{f}{2g} \times \frac{V^2}{d^5} \times l = \left(\frac{4}{3.14}\right)^2 \times \frac{0.023 \times (0.223)^2 \times 300}{2 \times 32.2 \times (\frac{1}{3})^5} = \frac{1.63 \times 0.023 \times 0.0494 \times 300}{64.4 \times 0.00411} = 2.1 \text{ ft of water}$$

EXAMPLE II

How much flow will pass through 300 ft of 4-in. standard iron pipe with 2.1 ft head loss?

Use right-hand side of Equation 3, call result X

$$X = \frac{d^{\frac{3}{2}} S}{Z} \times \left(\frac{h}{l}\right)^{\frac{1}{2}} = \frac{(\frac{1}{3})^{\frac{3}{2}} \times 62.4 \times (2.1)^{\frac{1}{2}}}{\frac{1}{1488} \times (300)^{\frac{1}{2}}} = \frac{0.192 \times 62.4 \times 1.45 \times 1488}{17.3} = 1490$$

Use left-hand side of Equation 3, with assumed $f = 0.01$

$$\frac{R f^{\frac{1}{2}}}{8.025} = X = 1490 \qquad R = \frac{1490 \times 8.025}{0.1} = 119{,}500$$

Draw X-line on Fig. 2, through point at R = 119,500, f = 0.01, slope 2 on 1

Then f = 0.023 (check Example I)

Use Equation (1a) to find flow = 100 gpm

EXAMPLE III

Find minimum pipe size that will pass 100 gpm through 300 ft of pipe with 2.1 ft head loss.

Use right-hand side of Equation 4, call result T

$$T = \frac{V^{\frac{3}{5}} S}{Z} \times \left(\frac{h}{l}\right)^{\frac{1}{5}} = \frac{(0.223)^{\frac{3}{5}} \times 62.4 \times (2.1)^{\frac{1}{5}}}{\frac{1}{1488} \times (300)^{\frac{1}{5}}} = \frac{0.406 \times 62.4 \times 1.16 \times 1488}{3.13} = 13{,}970$$

Use left-hand side, with assumed $f = 0.01$

$$\frac{R f^{\frac{1}{5}}}{2.659} = T = 13{,}970 \qquad R = \frac{13{,}970 \times 2.659}{0.398} = 93{,}400$$

Draw T-line on Fig. 2, through point at R = 93,400, f = 0.01, slope 5 on 1

R = 79,000 *f = 0.023 (check Examples I and II)*

Use Equation (1a) to find pipe size = 4 in.

proper viscosity value and friction-factor curve.

If the problem is to find out how much fluid will pass through a given line with a specified head loss, neither Reynolds number nor friction factor can be calculated since the flow is not known. Most engineers have been accustomed to assume a flow and get the answer by trial and error.

This article shows a direct way of solving this problem. By making some algebraic calculations and plotting one curve (or a tabulation), the trial-and-error method can be avoided; however, the calculations are somewhat cumbersome. Therefore, only so much of it will be treated here as will permit an understanding of the simple graphical solution.

We start by solving Formula (2) for c and setting the result into Formula (1) to get Formula (3) which is simply another form of the equation for the friction loss. The right-hand side of this equation contains only quantities that are known for the given case and its numerical value can be computed immediately. The left-hand side contains the R and f values which pertain to our case of flow, but are yet unknown. Their magnitude is fixed on one hand by the conditions of our problem through this Equation (3); on the other hand they are related to each other by the respective friction-factor curve, such as shown in Fig. 1.

Curve of Products

If the problem to be solved required the use of the curve for standard iron pipe, we could read off several *corresponding values* of Reynolds number and friction factor from Fig. 1 and compute with each set the magnitude of X for many values of the left-hand side of Equation (3). Then we can plot the series of these products as a curve (or tabulate them) against either the friction factor or the Reynolds number. This done, we compute, with the given data of our problem, the numerical value of the right-hand side of Equation (3) and find for this X value the corresponding f or R from the above-mentioned curve or tabulation.

They will be the correct values pertaining to our problem and we can figure the velocity c or the flow V by using the f value in either Equation (1) or Equation (1a). However, we can figure them also from Equation (2) by using the R value we found for our problem.

The foregoing computation is not too difficult and would be quite satisfactory

TABLE I

$$h = f \times \frac{l}{d} \frac{c^2}{2g} \qquad (1)$$

$$h = \left(\frac{4}{\pi}\right)^2 \times \frac{f}{2g} \times \frac{V^2}{d^5} \times l \qquad (1a)$$

$$R = \frac{d c S}{Z} = \frac{4}{\pi} \times \frac{V}{d} \times \frac{S}{Z} \qquad (2)$$

$$X = \frac{R f^{1/2}}{8.025} = \frac{d^{3/2} S}{Z} \times \left(\frac{h}{l}\right)^{1/2} \qquad (3)$$

$$T = \frac{R f^{1/5}}{2.659} = \frac{V^{3/5} S}{Z} \times \left(\frac{h}{l}\right)^{1/5} \qquad (4)$$

h = head loss in ft of the fluid itself
l = length of pipe in ft
d = inside diameter of pipe in ft
c = average velocity in ft per sec
S = density of fluid in lb per cu ft (62.4 for water)
π = 3.1416
g = 32.2 ft per sec per sec
Z = viscosity in lb per ft sec (centipoises ÷ 1488)
V = flow in cu ft per sec
R = Reynolds number
f = friction factor (for turbulent flow)

if it were not that a simple graphical method gives the same results without plotting a separate relationship for each friction-factor curve.

This graphical construction is made simple by plotting the friction-factor curves on logarithmic paper, as in Fig. 1. Then, for any numerical value, X of the right-hand side of Equation (3), all possible combinations of friction factor and Reynolds numbers for the particular problem will lie on a straight line parallel to the X lines of Fig. 2, which is a large-scale replot of part of Fig. 1. The slope of the X line is upward to the left with a slope of 2 to 1 if the scales of the coordinates are equal as in both Fig. 1 and Fig. 2.

The X lines in Fig. 2, all parallel, are guide lines for convenience in solving an actual problem. In order to locate the proper X line for a given problem, see example drawn in on Fig. 2, one point must first be calculated for same. Compute the numerical value of the right-hand side of Equation (3), assume any value of f, preferably 0.01, and calculate a corresponding, but hypothetical, value of Reynolds number, R. Locate this hypothetical R value along the base of the chart ($f = 0.01$) and draw a line parallel to the guide line X as illustrated. This will intersect the friction factor curve at correct values of f and R for the problem.

Numerical Solution

Example II shows the computation of friction factor and Reynolds number for the same pipe problem as Example I. Using the head loss of 2.1 ft found in Example I, the right-hand side of Equation (3) becomes 1490. Assuming $f = 0.01$, the hypothetical R is found to be 119,500. On Fig. 2, a line drawn from point $f = 0.01$, $R = 119{,}500$ parallel to the X lines (see heavy dashed line) intersects the friction-factor curve for standard iron pipe at $f = 0.023$, $R = 79{,}000$ which check values used in Example I. Having determined the correct friction factor f and Reynolds number R, the flow V can be calculated directly from Equation (1a) by using f or from Equation (2) using the R value. The latter is more convenient.

This graphical construction has the advantage that the single computation and construction of one X line is correct for any of several friction-factor curves that may have to be used. For example, the construction for Example II could be used with the friction-factor curve for smooth tubes and f is found without any further work to be 0.0185 and $R = 89{,}000$.

The third case comes about when the problem is to find the minimum *pipe diameter* required to carry a given flow with a specified head loss. For this problem, we solve Equation (2) for diameter, d, and insert the resulting expression into Equation (1a) to get Equation (4), which again is but another form of the friction-loss equation.

As in the previous case, Equation (4) can be similarly evaluated by computing the magnitude of T for several corresponding friction factors and Reynolds numbers taken from Fig. 1 and plotting same as a curve against either f or R. Then compute the numerical value of the right-hand side of Equation (4) and finally find for this T value the corresponding f or R value from the above-mentioned curve.

The graphical solution of the problem, however, is simpler and is based again on the fact that in the logarithmic plot of the friction-factor curve, all possible combinations of f and R which satisfy the left-hand side of Equation (4) with T fixed by the data of the problem will lie on a straight line leaning to the left. This line will have a slope of 5-to-1 if the scale for the coordinates is equal in both directions. Fig. 2 contains such T lines as reference or guide lines.

To locate the respective T line properly on the plot, we compute the numerical value of the right-hand side of Equation (4), then figure for this T value and $f = 0.01$, a hypothetical Reynolds number which we locate on the base line. This will be the base point for the T line pertaining to the given problem and, if we draw through this base point, a line parallel to the T guide line, it will cross the friction-factor curve at the proper values for our problem. Example III shows the calculation for the data of Example I, with a numerical result of 13,970 for T.

With this value for T, and the assumed value of friction factor ($f = 0.01$), the Reynolds number for drawing the T line is found as $R = 93{,}400$.

Once friction-factor and Reynolds number are established, either Formula (1a) or (2) can be used to find diameter of pipe. The diameter so found is the minimum diameter. If this diameter is not feasible, we select the next larger standard pipe or tubing. Quite naturally, with this larger diameter the head loss will be less than originally assumed for the problem. If this final head loss is required, we simply figure the value of the Reynolds number for the selected diameter, find the corresponding friction factor and figure the correct head loss from Equation (1a).

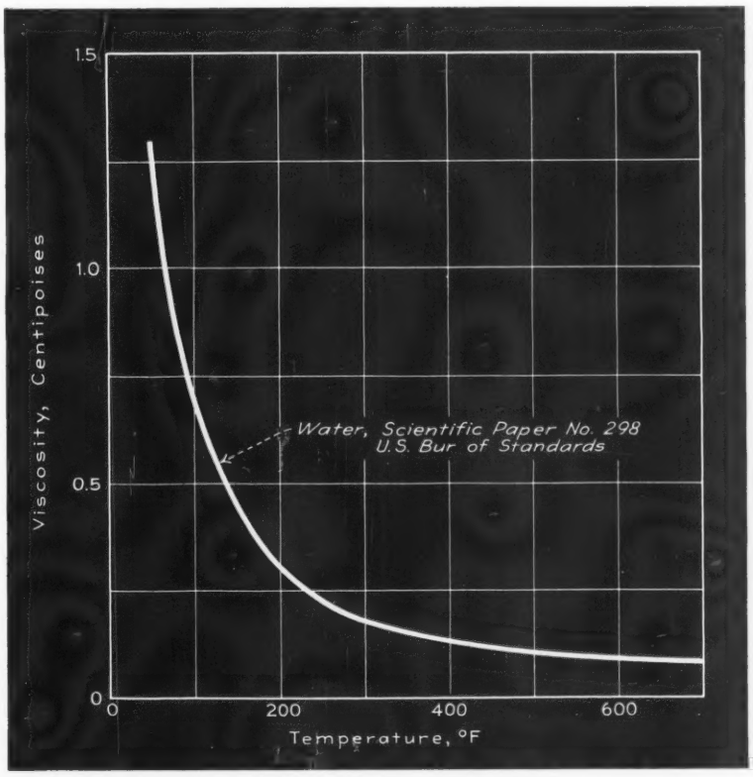


Fig. 3—Viscosity-temperature relation for water

The values of friction-factor of Figs. 1 and 2 were given to the writer by W H McAdams in a letter on Jan. 3, 1935, as the proposed values of the article "Friction Factor for Clean Round Pipes" by Drew, Koo, McAdams in *Trans AIChE*, Vol 28, pp 56–72.

How To Select and Maintain

Practical hints on the construction, application and care of flat-rubber and multiple V-belts

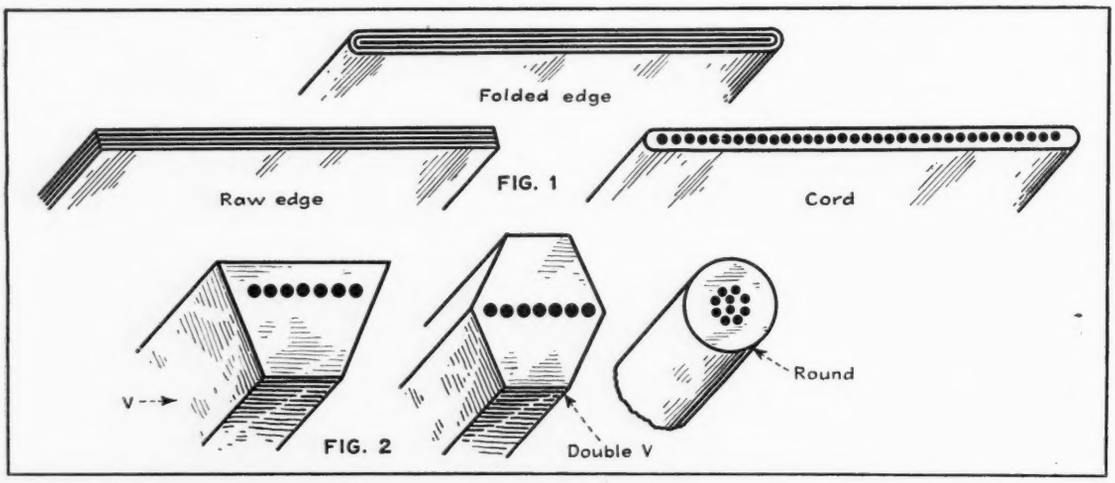


Fig. 1 — Flat ply-fabric-rubber belt constructions. Fig. 2 — V- and round rubber-belt constructions

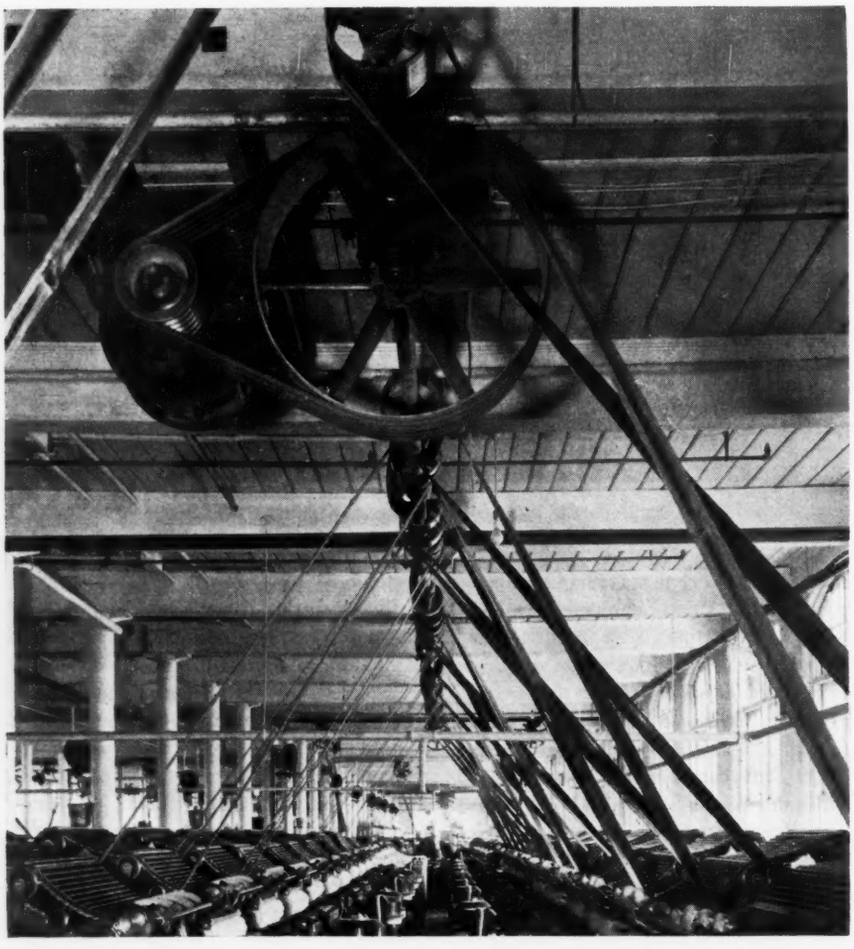


Fig. 3—A 5-strand multiple V-belt connects 40-hp motor to line shaft, from which carding machines are driven—an example of modern group drive

RUBBER BELTING is manufactured in several different shapes, constructions and rubber compounds. These give varying degrees of strength, stretch, pulley grip, mechanical precision, and smoothness; also protection against abrasion, oils, moisture and corrosive fumes. No single belt or type can do all of these things, however. So, to aid the buyer and user, here are some of the fundamental distinctions and characteristics of different types of rubber belting.

Cotton and rubber, or synthetic-rubber compounds, are the materials used in practically all power-transmission rubber belting. Cotton duck or fabric of either the conventional woven kind, or that known as cord fabric, impregnated and covered with rubber or synthetic-rubber compounds, form the structural element of ply-fabric-rubber belts. Cotton cord is now used as the stretchless element in cord belts made by several leading manufacturers.

Until about 15 years ago, almost all rubber belting was of flat ply-fabric construction made either with raw or folded edges, Fig. 1. These types still constitute a great bulk of rubber belting made today. Folded-edge belts are designed for general use on drives where excessive edge wear results from belt shifters, guides, and pulley flanges, or where the drive is subjected to corrosive fumes or the weather.

Rubber Belts

By JAMES ADAMS, Jr
The Manhattan Mfg Div of Raybestos-Manhattan, Inc

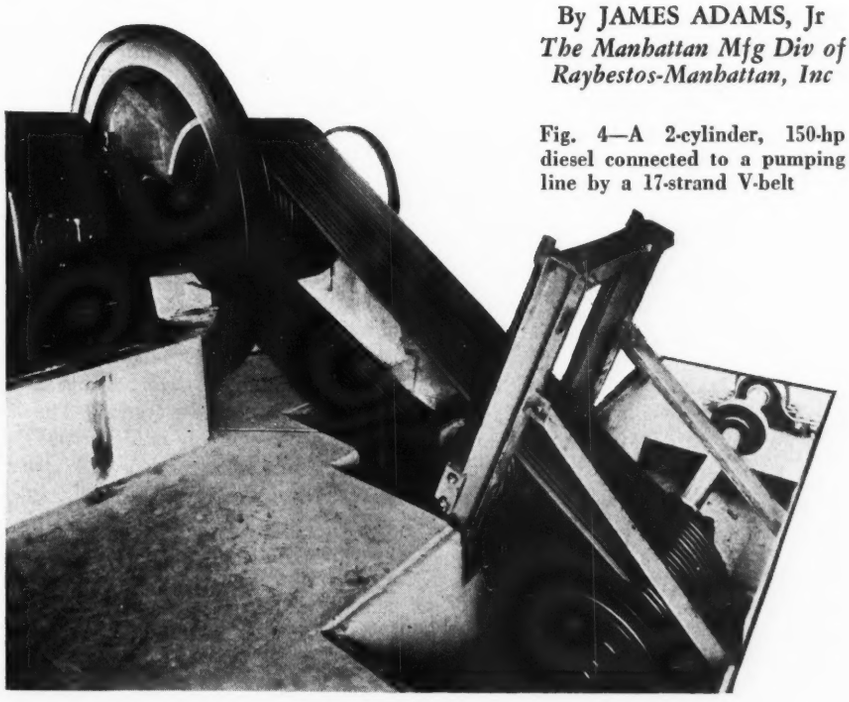


Fig. 4—A 2-cylinder, 150-hp diesel connected to a pumping line by a 17-strand V-belt

Folded-edge belts usually have a cover seam on the side not intended to run on the pulleys.

Raw- or square-edge belts, made of harder ducks than folded-edge types, are also designed for general power-transmission work. These are particularly applicable for use on idler and serpentine drives, where they are subjected to severe bending and wear on both faces. All ply-fabric-rubber belts can be successively trimmed to narrower widths if drive changes require it.

Flat-ply-fabric belts are the proper choice where their ends must be connected with fasteners. They will take any type of fastener, plates, lacing, hook, or gathered joint. However, the best fastener belt is never as good as an endless one. It is frequently worth the additional inconvenience and expense to make rubber belts endless.

Endless belts are recommended on drives with small pulleys, where service conditions are severe, and belt speeds are over 5000 fpm. If the drive will take a factory-made endless belt, either the folded- or the raw-edge ply-fabric and cord belt are available. Raw-edge types are preferable where belts are to be made endless on the edge. Folded-edge and cord belts are also field-vulcanized-endless.

A certain tension is necessary to hold belts snugly against pulleys. Some of this tension is lost when the belts stretch. When belts are operated on pulleys having fixed centers, they must be cut to a length that will give them sufficient tension to compensate for stretch during operation for a reasonable period before they have to be shortened. A rule of thumb for measuring the length of flat-ply fabric-rubber belts is to make them ⅛ in. per ft shorter than the length around their two pulleys, measured with a steel tape.

Ordinary ply-fabric-rubber belts, made of standard 28- or 32-oz duck, will stretch from 2 to 3% in service and will thus require two or three take-ups. Rubber-covered belts and those made from the light ducks stretch between 1 and 2% and probably will require 1 or 2 takeups in service. Amount of stretch also depends on how heavily the belt is loaded. In any case, follow the rubber manufacturer's table of belt stretch for the conditions at hand.

Preconditioning Belts

Length of regular ply-fabric-rubber belts varies with sustained changes in atmospheric humidity. Therefore, we recommend that these belts be preconditioned, by letting them stay unrolled for 48 hours where they are to be used, before cutting to fit the drive. This prevents fastener trouble or overheated bearings due to belt shrinkage, or an extra takeup if the belts lengthen.

Where the drive has an automatic takeup, such as an idler or a pivoted motor base, a rubber belt will not require shortening. When a ply-fabric-

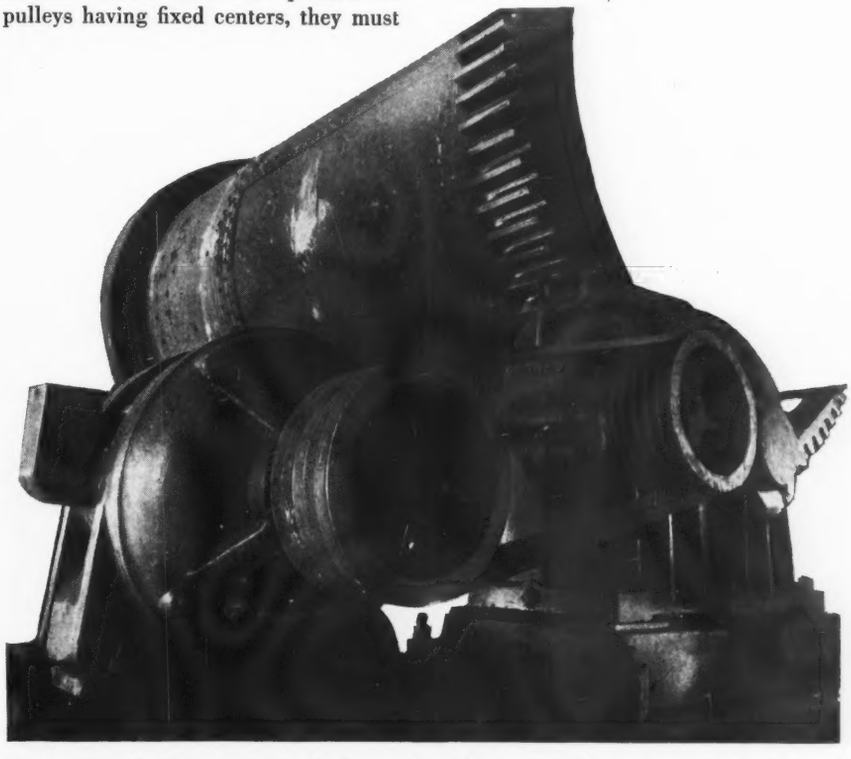


Fig. 5—A 75-hp, line-start, squirrel-cage induction motor drives a coal drier through a 5-strand multiple V-belt and a gear speed-reducing unit

rubber belt is removed from a drive during repairs, it should be rolled up and left near the drive. If a roll of belt is laid on its edge over night on a wet floor, shrinkage on the wet side may make it run crooked. Cord-rubber belts are affected very little by humidity changes and have practically no stretch except due to elasticity.

Short-center drives may be considered as those where the distance between pulley centers is less than twice the larger pulley diameter. If the shaft centers are fixed, an idler pulley will maintain belt tension and take up belt stretch if necessary. For electric-motor drives, a pivoted motor base will automatically control belt tension and compensate for stretch by permitting the weight of the motor and its reaction torque to act on the belt. All tension-control devices are adjusted to a proper position when they are installed. If a belt stretches excessively, the tension base should be carefully readjusted to proper operating position. Neglect to do this may result in a badly burned or worn belt due to insufficient tension. This danger is not present with high-grade rubber belts properly installed and adjusted before being put into service.

Standard rubber belts have an outside surface of cotton fabric impregnated, but not covered, with rubber or synthetic-rubber compounds. These are known as friction-surfaced belts. When rubber belts are used on windup and other drives requiring high rates of slip, they must slip without overheating or burning. For these drives, rubber belts with a bare-duck surface (commonly called "bareback") are used. Where the highest flat-belt friction on the pulley is desired, rubber belts with a specially treated surface are made by several manufacturers. The pulley surface of these belts should be periodically dressed as recommended by the maker.

Where severe conditions of acids or alkalies and moisture exists, belts with rubber or synthetic-rubber covers, somewhat similar to those used on conveyors, are available. Similar in another respect to conveyor belting, rubber-covered transmission belting will stand severe abrasion and is practically immune to changes in atmospheric moisture.

Heat has always been an enemy of every kind of belting. Leather dries out, Balata gum melts, and the ordinary rubber belt ages and cracks. Likewise, mineral oils are bad for belting, specially for ordinary rubber belting. A few drops of lubricating oil now and then will not injure a rubber belt, but when continuously subjected to lubricating oil it will swell and loosen the rubber bond. Synthetic-rubber compounds are now available that have high resistance to heat and oiliness.

For short-center drives of practically every kind, rubber strand belts, singly and in multiple, have come into wide use. These belts are made in single V; double V, for driving from both sides; and round cross sections, Fig. 2. They are made in ply-fabric, cord-fabric and cord constructions, the cord types having the least stretch.

Except for the larger-size fabric types, practically all rubber V-belts are made endless and are therefore substantially limited to drives that can take an endless belt. V-belt motor drives, Fig. 3, applied in the middle of a line shaft, are made by installing a coupling next to the driven pulley, through which to admit the belts.

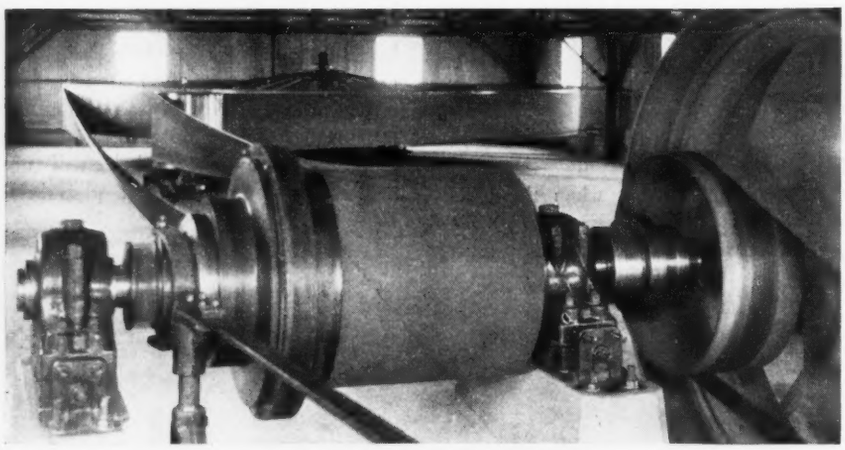


Fig. 6—A 26-in. cord rubber belt 184 ft long operating quarter-turn drive on oil-pumping band wheel through a clutch from lineshaft

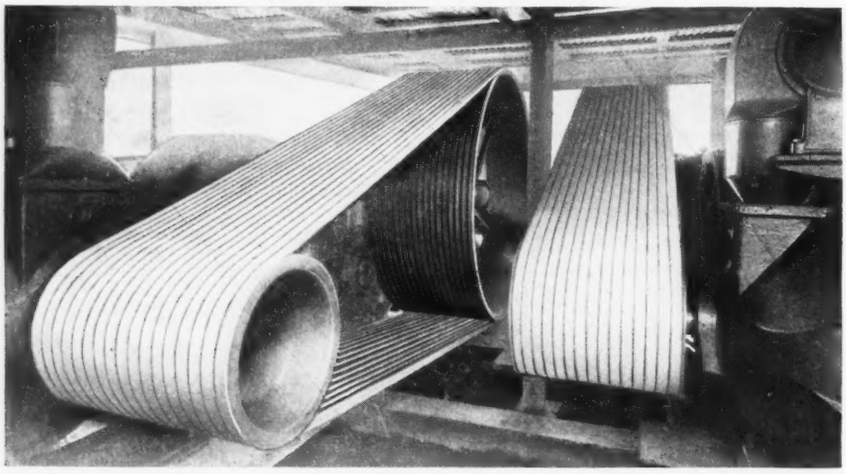


Fig. 7—A 17- and a 15-strand multiple V-belts drive slush pumps in an oil field

V-Flat Drive

V-belts are sometimes used to drive a large flat pulley with very little crown, from a small grooved sheave, Fig. 3. This kind of a drive is known as a V-flat. The V-belt grip on the sheave is about equal to that on the flat pulley when the belt wraps 110 deg around the sheave. Thus, it would not be economical to replace a large pulley with an expensive, grooved sheave when the V-belt grip on the large pulley equals that on the sheave. Single or multiple V-belts may be operated quarter turned, and single V-belts may be operated crossed on grooved sheaves. Adjustable-diameter grooved sheaves are available by which a change in speed can be made with the turn of a wrench or other adjusting medium. These are applied with V-belts on several designs of variable-speed transmissions.

When selecting V-belts for a multiple drive, they should be matched as to construction, length, and width. If one belt on a multiple drive breaks in service, let the rest of the belts carry the load until a new matched set is obtained. Install the new matched set, and keep the remainder of the old belts for emergency.

Everything seems to show that explosion doors and other devices can't help much when a real blast occurs. It's up to the operator to steer clear of trouble by knowing what causes explosions and how to prevent them. Here are the facts needed to keep your plant safe

Furnace Explosions— An Operating Responsibility

By HARRY M SPRING

REALIZATION of the damaging power of boiler explosions brought passage of stringent boiler codes and license laws, followed by an appreciable reduction of accidents in this country. However, the hazard of furnace explosions does not always receive the attention it deserves. Loss of life and property may be high in these blasts, and they have occurred far too frequently in recent years.

As the following questions and answers show, this is primarily an operating responsibility. POWER readers, with the facts before them, can contribute to public safety by conscientiously observing the simple basic rules for avoiding such accidents.

What is a furnace explosion?

A furnace explosion is the ignition and almost instantaneous combustion of explosive or highly inflammable gas, vapor, or dust accumulated in a boiler setting. Because of the rapidity of combustion and heat generation, the expansive forces may be far greater than the setting can stand.

In minor explosions, called "puffs", "flare-backs", or "blow-backs", flames may blow suddenly for a distance of many feet from all firing and observation doors and anyone in the flame path may be seriously or fatally burned. Such minor explosions, even if no real damage is done, indicate dangerous conditions and should not be ignored.

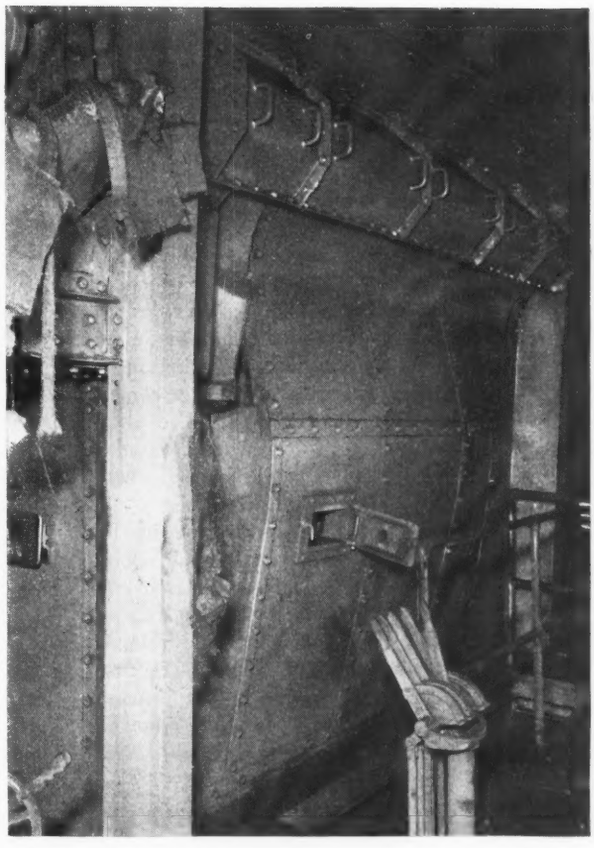


Fig. 1—Damage to water-tube boiler caused by furnace explosion

Heavier explosions may shatter gas baffles, bulge setting walls and loosen refractory, with possible damage to the boiler itself resulting from the shock. Violent explosions have blown brick tops of boiler settings through roofs, blown the sidewalls out from under the boiler, and broken all connecting piping.

Does explosion risk depend on type of fuel?

Furnace explosions may occur with any type of fuel. They occur far more frequently, however, when fuels burn in suspension than in solid form on grates. This means that the risk is greater with pulverized coal, oil, gas, and waste-heat units. Insurance rates covering furnace explosions in large boilers are about 9 times as great with oil and pulverized coal and about 11 times as great for gas as they are for solid fuels. These rates are scaled in proportion to the estimated hazard.

What kinds of furnace explosions are there?

Furnace explosions are commonly divided into gas explosions and dust explosions; each results from the presence of unburned fuel and its delayed ignition. Furnace explosions may also be divided into primary and secondary classifications.

For example, a quantity of unburned fuel in the primary combustion chamber, or furnace, may distill off a considerable volume of gas during a period of interrupted ignition. If this gas does not ignite soon, it may fill the furnace and circulate back to a secondary pass.

Continued ignition delay may cause volatile content of the unburned fuel to be exhausted and the major part of

the gas to pocket in the second or third pass of the setting. When the diluted gas mixture remaining in the furnace ignites, because the burner is relighted, or for some other reason, a furnace explosion of minor intensity occurs in the primary chamber. The blast of flame may then follow through to ignite the gas in the succeeding passes in a secondary and more violent explosion.

What causes gas explosions?

The primary cause is unburned fuel. A quantity of gas may accumulate in some part of the furnace or setting when gas is used for fuel, or, in oil or pulverized-coal units, unburned fuel on the hot furnace floor may distill off highly inflammable gas, when the burners are not in operation.

This gas may also find its way into furnace or setting pockets. No matter where the gas comes from, ignition will cause combustion with explosive force. Relighting the burners may set it off, or the gas may permeate cracks and ignite from contact with hot brickwork.

What causes dust explosions?

Naturally, dust explosions occur most frequently on pulverized-coal units. Improper adjustment or condition of the pulverizer may impair the fineness of the coal, so that some of the larger particles are not completely burned. In time, the upper parts of tubes may pick up a heavy layer of this unburned fuel. When a burner is lighted, a minor primary explosion may occur, due to delayed ignition. This "puff" may jar the tubes, dislodging a heavy cloud of coal particles. If the coal-air ratio lies within the dangerous range, a violent secondary explosion will follow.

Can a burner ignitor cause an explosion?

Some burners use an auxiliary pilot flame, burning gas. If the pilot goes out accidentally when the main burner is off, the entire setting may be filled with gas. Fire departments in some cities prohibit gas pilots unless equipped with automatic shut-offs to stop the gas flow if the flame goes out.

How about fans and dampers?

Accidental stoppage of the induced-draft fan, with continued operation of the forced-draft fan, results in fuel being fed to the furnace faster than combustion products leave. Mechanical or electrical interlocks prevent this condition, and also the possibility of starting the forced-draft fan unless the induced unit is running. A tightly closed damper creates a situation similar to the stoppage of an induced-draft fan. Cutting back dampers, as shown in Fig. 2a, makes it impossible for them to close tightly. This is a wise precaution on units burning fuels in suspension.

What about coal characteristics?

During light-load periods, a "cold" furnace has little igniting tendency, and with pulverized-coal low in volatiles, the flame may be unstable. Unless closely watched by the fireman, the flame may go out. The following drop in steam pressure will cause the automatic controls to increase coal feed and the furnace may be filled with an unburned mixture of pulverized coal and oxygen. A dust explosion may result, or the coal may settle to distill off the volatiles, resulting in a gas explosion before the burner comes on again or when it does. Use of a smaller burner for low-load periods, or burning higher-volatile coal, will prevent explosions of this type.

To find out if a furnace explosion in a pulverized-coal installation could have been a gas explosion, search out all coke in the combustion chamber. Weigh the coke, compute the volume of gas given off, and calculate the gas-oxygen ratio using the known furnace volume. This will indicate whether the mixture was in the explosive range.

What precautions will prevent explosions in starting up?

In starting up pulverized-coal, oil, or gas units, (1) use a "rich" fuel-air mixture, (2) use properly designed ignition methods, whether a portable or stationary torch, (3) never allow the fuel-air mixture to ignite from the heat of furnace walls, or from another burner, (4) scavenge the furnace before starting (at least 5 minutes recommended) and be sure there is enough draft when lighting-off, (6) if the fuel does not ignite in a few moments, shut off ignitor and fuel supply and thoroughly scavenge furnaces and gas passes before again attempting ignition.

What precautions will prevent explosions during operation?

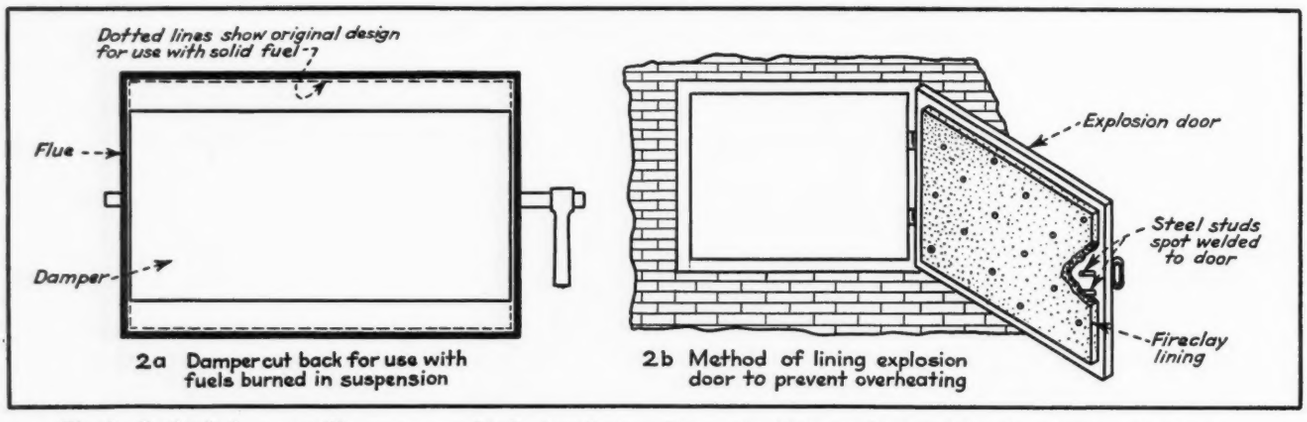
(1) Never leave the boiler operating unattended. (2) If a burner goes out accidentally, follow (6) above and then determine and remedy the cause of stoppage. (3) Keep burners and all allied equipment clean. (4) On boilers using both forced- and induced-draft fans, test the interlock periodically.

(5) Do not attempt to secure excessively high CO_2 by use of too rich a fuel-air ratio or by inadequate secondary air supply. (6) Keep temperatures and pressures for preheated air, drying air, fuel oil, etc, at right levels. (7) Do not allow an unstable flame condition to continue uncorrected.

Can boiler walls be built to stand explosion pressures?

Over 100 lb per sq ft pressure may result from major blasts. Steel-encased walls may be braced by steel columns of the buckstay type and cross girders, dividing external wall surface into sectors, so as to withstand about 40 lb, the pressure set up by explosions of moderate intensity.

Provide adequate explosion doors to warn operators of puffs, indicating serious conditions that may lead to a real explosion. These doors should be free



2a Damper cut back for use with fuels burned in suspension

2b Method of lining explosion door to prevent overheating

Fig. 2—Cut-back damper will prevent one kind of explosion. Doors should be studded and lined against overheating

to swing open and should not have latches. If the door tends to overheat, spotweld studs to the inner surface and apply a fireclay lining, as in Fig. 2b. Keep the openings clear and never fill them with brick. When an explosion door lies within 6 ft above any platform or operating level, provide a deflection plate at least 6 ft high (Fig. 3) to protect passers-by from being burned by the flame blast.

How much faith should be placed in explosion doors?

Explosion doors will not prevent damage in case of a major explosion. The cure lies in prevention alone. Opinions of leading authorities consulted on this point can be summarized as follows: "the question of explosion doors is perhaps the most debatable one in connection with explosions . . . the number and size depends on an arbitrary standard. It is probable that each maker has a standard of his own and it is also probable that there is no agreement among these standards.

"We doubt very much whether any explosion vent could be arranged to operate fast enough or to be large enough to really safeguard any installation . . . a slight puff or explosion will do not damage even if there is not an explosion door on the furnace, while a heavy explosion will do damage regardless of any explosion doors which are feasible . . . we have never recommended any form of explosion relief on oil-fired boilers. . . .

"Most explosion doors are so heavy that should an explosion occur, the sidewalls or boiler walls would break if sufficient energy is expended on the door to cause it to open . . . an explosion occurring at the bottom of the furnace would not even lift an explosion door at the top, although it might seriously damage the furnace at the bottom . . . it is the general belief that such explosion reliefs will create severe personal injury hazards . . . it is our thought that it is a good deal more important to arrange for positive ignition of pulverized fuel, oil and gas, than to provide explosion vents. . . ."

Why won't explosion doors work?

Experiments in explosion galleries show pressures considerably higher than those that would occur in a boiler setting, due to the velocity wave effect in a gallery. However, these experiments give valuable data on the time element. They show that the maximum rate of flame propagation in the higher explosive limits of pulverized coal and air is 2820 fps, and that a pressure rise of 588 lb per sq in. per sec may occur. It is the rapid rise in pressure or the dynamic load that causes most structural damage. What does this mean in respect to explosion doors?

Explosion relief vents ahead of the path of flame propagation increase the velocity and the "kickback", causing major damage at the point of ignition. A ½ sq ft vent at the origin is as effective as a 2 sq ft vent 20 ft along the path of propagation. An explosion door at the origin decreases the velocity of flame propagation and so reduces damage.

Interesting examples of the difference between vents along the path of flame propagation and at the point of origin are to be found in the many experiments and actual cases of buildings where brick walls have been wrecked but windows directly above have been left intact. Practically, however, it is impossible to follow these principles in boiler explosion doors because such doors, to date, have not been designed to withstand temperatures attained in the lower part of the furnace where ignition of most explosions begins.

Another difficulty in the way of venting explosions by doors lies in the size requirements. Curves from Arlington gallery tests indicate that doors of about 10 sq ft in area would be required per 100 cu ft of furnace volume in order to limit internal pressure to 40 lb per sq ft. The total area of explosion doors for a 7000-cu-ft furnace would thus run to 700 sq ft.

Working from another direction, calculations show that a theoretical pressure of 20,448 lb per sq ft would occur if there were no loss of heat or expansion between the tubes. Actually, under probable operating conditions, an unrelieved pressure of about 4500 lb per sq ft would result. The theoretical increase in gas volume would be 575,000 cu ft, or 255 lb. One authority advocates a relieving area of 1 sq ft for each 2500 lb per hr of gas flow, and on this basis 355 sq ft would be the minimum explosion-door area to limit the pressure in the 7000-cu-ft furnace to 40 lb per sq ft. This assumes that the gas must be relieved in 1 second, but since the time interval may be considerably less, the required area would be even greater than 355 sq ft.

No matter which way you figure it, it can be seen that it would be impossible to provide, under practical conditions, enough explosion-door area to keep explosion pressures down to a reasonable figure.

One can only conclude that the effectiveness of any explosion doors practical to install is limited to relieving minor puffs, warning attendants that operating conditions exist that might lead to serious explosions. Such warning is also given by flare-backs through burner ports, regardless of any explosion doors. If explosion doors are installed they should be as light as possible and located as close to the hottest part of the furnace as practical.

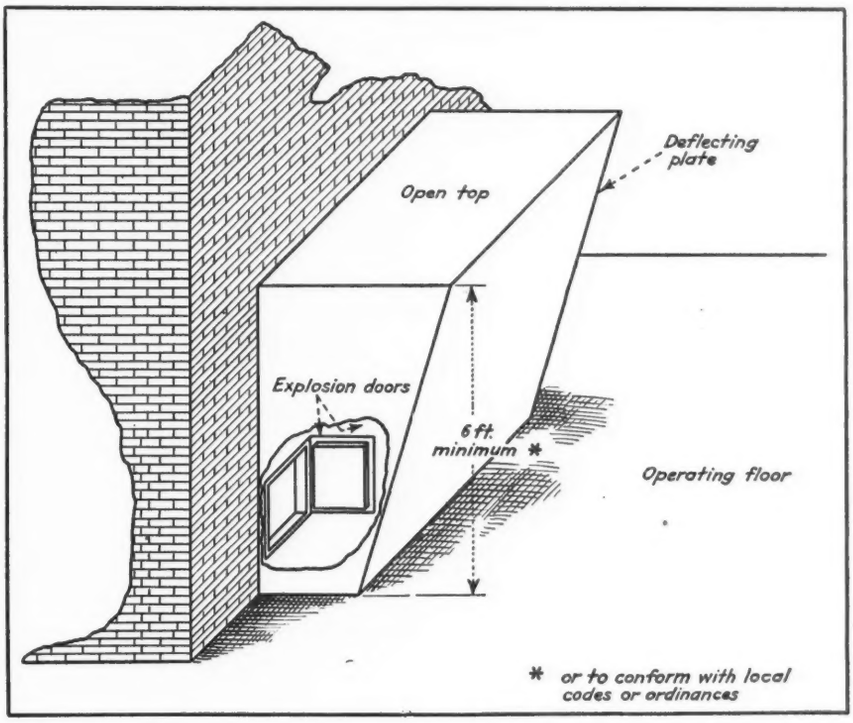


Fig. 3—A deflecting plate protects operators from flame blast at explosion doors

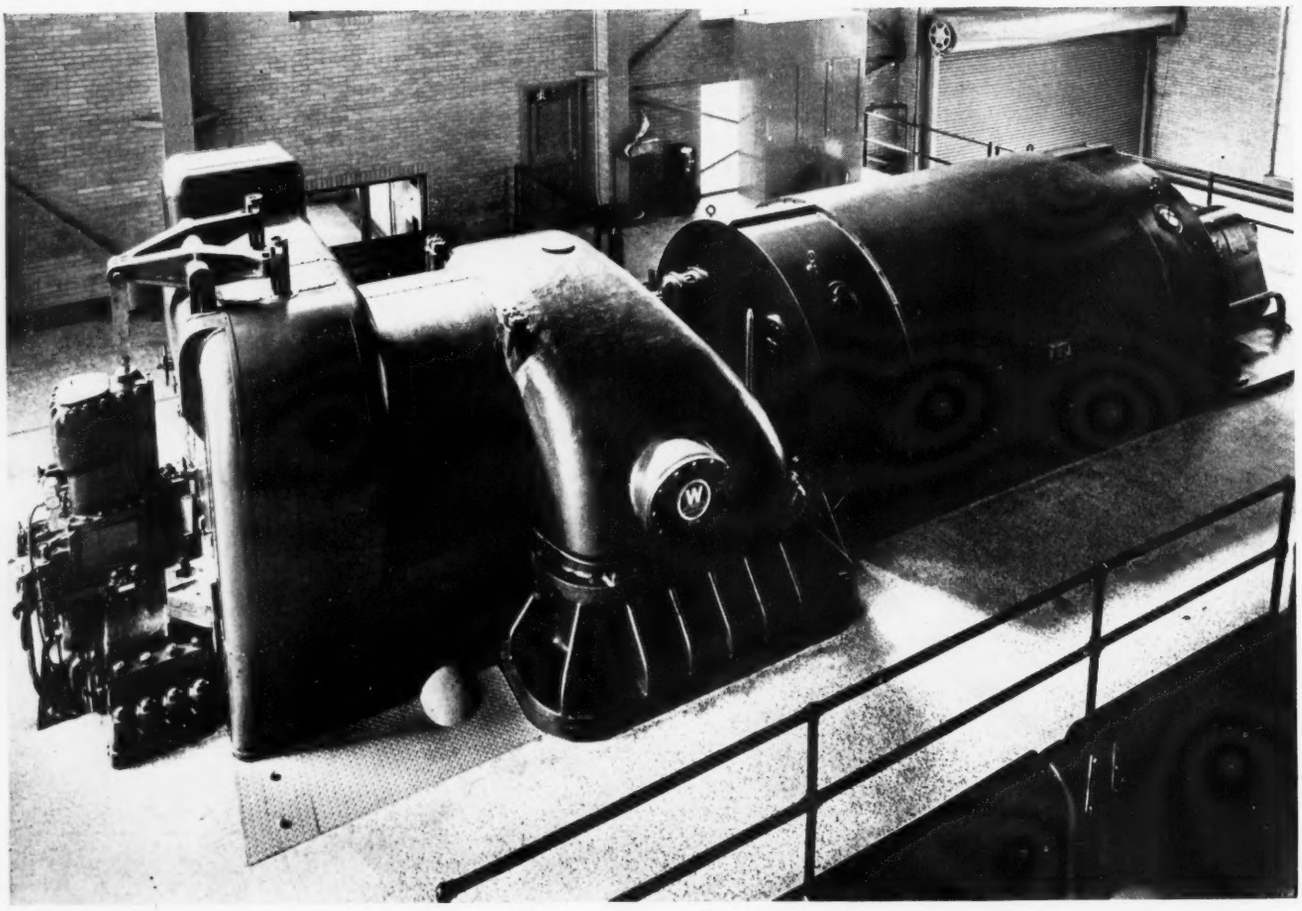


Fig. 1—Single-cylinder, 20,000-kw 3600-rpm unit at Ripley Station, Kansas Gas & Electric Co. Last two rows of blades are shielded

Operation OK's Blade Research

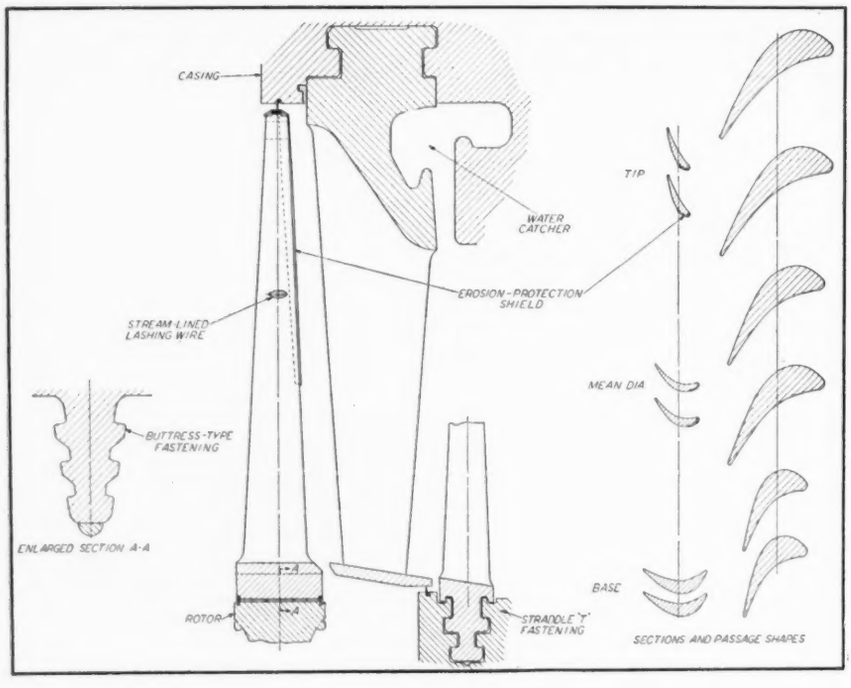
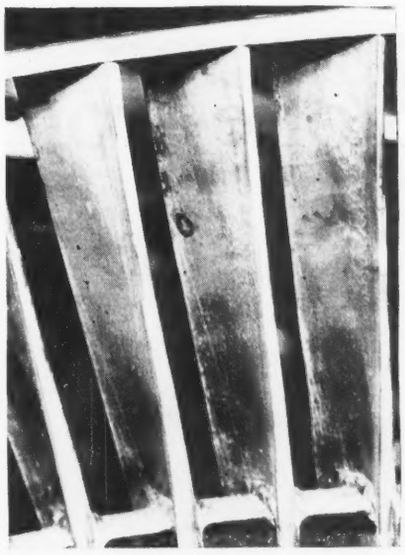


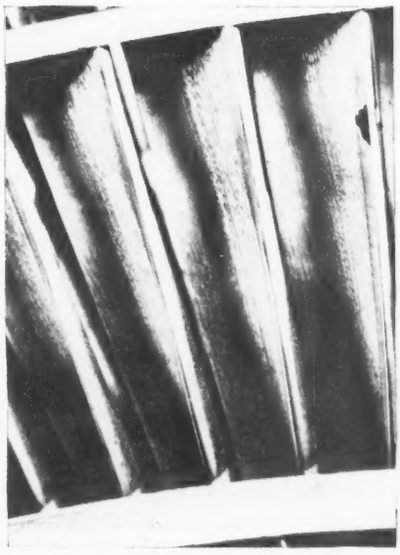
Fig. 2—Section through 20-in. exhaust blading showing location of shields and water catcher

Service records show good performance of low-pressure turbine blading operating at tip speed of 860 miles per hr. Moisture collectors and edge shields check erosion

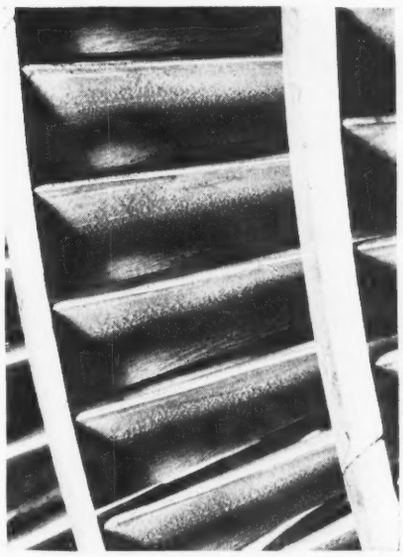
By NORRIS D GOVE
Westinghouse Electric & Mfg Co
South Philadelphia, Pa.



Last row, shielded



2nd from last row, shielded



3rd from last row, not shielded

Last 3 stages

Fig. 3—Low-pressure blading after six months operation. Note signs of erosion on third row (not shielded), good condition of shielded rows

OPERATING EXPERIENCE with two new turbines has given excellent opportunity to determine performance of low-pressure turbine blading operating at high peripheral speed. One machine is the 25,000-kw unit installed in the Montville plant of the Connecticut Light and Power Company by Westinghouse in 1937. This machine (largest 3600-rpm single-cylinder condensing turbine in the world) takes steam at 640 lb g, 825 F and exhausts at 29-in. vacuum.

During the following year a similar unit was installed in the Ripley Plant of the Kansas Gas & Electric Co where it has completed a year of almost continuous operation followed by annual inspection and return to service.

Three Years Service

For years it has been generally understood that limitation of largest economical size of a condensing turbine lies in the exhaust blading. In the turbines mentioned above, the last rotating rows of blades, shown in Fig. 2, have an active height of 20 in. above a 40-in. diameter hub. This means a tip diameter of 80 in. and a tip velocity at 3600 rpm of 1258 ft per sec. These blades in the two machines now have a total service record of more than three years with practically no erosion.

Low-pressure blade erosion has for years been a source of expense to turbine operators. It has often been felt that the economic advance in boiler pressures without reheat would be influenced by the cost of replacing condensing-turbine exhaust-end blades worn away by moisture. The designers realized that no matter how much mechanical strength and stability they could build into the blades, success would not be complete unless erosion were reduced. This seemed particularly important since about 13% moisture at the exhaust was expected.

Designers reviewed progress toward this end for the past half dozen years and attacked the problem on three fronts. First came the addition of Stellite shields on the inlet edge of the blade to present a hard and durable surface to resist impingement of flying water particles.

The second measure was the design of improved water catchers ahead of each of the last two rotating rows of blades to entrap and drain out a considerable part of the water and thus reduce the bombardment.

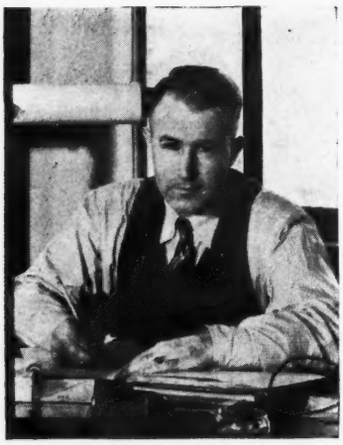
The third step was the development of blade shapes and angles to produce not only an efficient passage for the steam, but also a form which would best conduct the relatively low velocity water droplets to reduce impingement.

After some six months of regular operation, the Montville turbine was opened and the low-pressure blades examined and photographed. Traces of erosion were remarkably slight. After nine more months of practically continuous operation, the turbine was again shut down for annual inspection. No material increase in erosion over that recorded nine months earlier could be detected.

The Ripley unit at its first annual inspection exhibited the same high resistance to erosion. These two cases furnish sufficient evidence that, with careful attention to the fundamentals and refinements of design, high blade speeds do not constitute an operating hazard nor an economic handicap.

Spotting Smoke from "Office on Skyhooks"

By PHIL SWAIN, Editor



Ernest Brundage, Rochester's smoke inspector, has been on the job since 1936. Before then, he was a practical operating engineer. Besides keeping the air clean over one of America's most beautiful industrial cities, Brundage is active in several engineering organizations — past state (N.Y.) president of the NAPE, on the national educational committee of the Craftsmen (UCCE), secretary of the International Union of Operating Engineers, Local No. 71

EVERY MAN is entitled to his dream. That of the go-getting smoke inspector is a comfortable and efficient office, glass walled and well heated, suspended by skyhooks above the exact geographical center of the district to be inspected.

This dream came mighty close to realization in Rochester, N. Y., last fall, when city smoke inspector Ernest Brundage moved into a new penthouse office built high above the roof of the Lincoln Alliance Trust Co Bldg at 183 Main St, East.

Big windows on all four sides give a clear view for miles, and all around the circle. Here sits the inspector, when he has time to sit, with an unobstructed view of practically every stack in greater Rochester. For a spot closeup he can quickly roll to any window the big telescope mounted on casters and equipped with an air-cushioned adjustable standard.

Tracking Down Smoke

Let's say the phone rings. Man complains that Stack *X* is smoking again. Brundage swings around in his chair and catches it in the act, thereby saving a lot of argument and letter writing. As I see it, this is a super broadcasting system. Name any plant in Rochester and the inspector can get an immediate report direct from the stack itself.

Right here it must be granted that Brundage can't watch all the stacks all the time; doesn't even try. In any case, there will be enough formal complaints to keep him busy. But his crow's-nest vantage point makes it easy for him to see whether so-and-so, who was warned (after formal complaint) and promised to do something about it, is really doing something or just playing for time.

The present smoke ordinance, dating back to 1914 without change, is simple but stringent. It provides a single density standard, not a smoke scale. This standard, slightly lighter than Ringlemann No. 2, is made by ruling (on a dead white surface) black lines 1/24 in. wide on ¼-in. centers. The "color" of this chart, viewed in the open air at a distance not less than 100 ft, sets the dividing line between light smoke and "dark smoke".

They built the inspector a penthouse office on top of the town

Going far beyond the requirements of most cities, this ordinance limits the emission of such dark smoke to not more than 5 minutes once in 4 consecutive hours. Exceptions to this rule are permitted only between 5 and 7:30 AM. A paragraph on soot reads "Soot must not be expelled or suffered, permitted or caused to escape from any stack flue or chimney." The penalty provided for each offense is a fine not exceeding $50 or imprisonment not exceeding 50 days, or both.

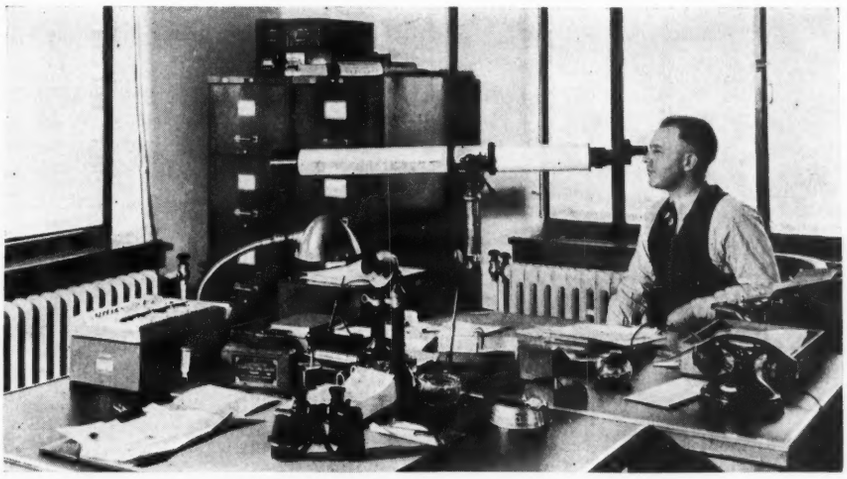
Knowing that this matter of smoke ordinances and their enforcement has long been a governmental headache in all American industrial cities, I asked Mr Brundage to tell me frankly how Rochester fares in this respect, whether smoke ordinances are generally enforceable and whether cities are generally cleaner because of them.

Said he, "In my opinion the smoke situation in Rochester would be at least four times as bad as it is if we did not have this ordinance and an active setup for its enforcement. Some few plants would voluntarily abate smoke, but most would not incur added expense and trouble to eliminate smoke if there were no legal compulsion.

"Here's something to remember: Rochester was originally a hard-coal town. In recent years, particularly during the depression, many plants changed to soft coal to cut fuel bills. These include 50 of our city schools; all of the city schools were burning anthracite at the turn of the century. Yet the smoke complaints in this office in 1939 were less than in any year since 1929. I think that is significant."

In stressing the importance of smoke ordinances and their enforcement, Brundage reminded me that tact and common sense are equally necessary. Many cases require special consideration. If the equipment is at fault, a plant can't be rebuilt in a day, nor in

the middle of the heating season when all boilers are loaded to the gills. You've got to allow a violator reasonable time in which to get his plant in line after a warning. What is a reasonable time will depend on many human, financial and engineering factors.



Telescope and typewriter, tools of the smoke spotter's trade, are right at hand

Brundage has been running dust tests since 1937. Each month he fills his car with a dozen capped round glass jars (5 in. diameter by 11 in. high). He deposits these on selected roofs along a circle about midway between the business center and the outskirts of the city. He picks a spot not easily reached by the public, uncaps a jar and leaves it in place for about 30 days to pick up any dust that may settle in it. The jar contains water plus glycerine and another chemical to prevent evaporation or freezing.

After 30 days, he puts out another set of jars and delivers the old ones to the city laboratory for dust measurements. He recalculates the lab results to the basis of tons per sq mile per 30 days and tabulates the results for comparison with similar tests in other cities.

✦ ✦ ✦

New Gas-Engine Heat Recovery

Tests show "high-temperature" cooling, with water above 212 F, brings no mechanical troubles and vastly increases possibilities of heat recovery from jacket water and exhaust gas

HIGH-TEMPERATURE cooling, based on use of jacket-water temperatures above 212 F, makes possible better methods of heat recovery and promises important savings to gas-engine users, according to a recent report by the Gas-Engine Power Committee, Industrial Gas Section, American Gas Association. With an average of 30% of the total energy content of the gas fuel being "wasted" as heat into the jacket water and another 35% into the exhaust, it can be seen that any improvement in ways of putting this 65% to useful work would widen the field in which use of gas-fueled engines can produce savings.

In the usual arrangement, the jacket-water flows in a closed circuit, giving up its heat in some form of heat exchanger. Exhaust heat is recovered by (1) taking the exhaust directly through a second heat-exchanging device such as a warm-air heater or boiler, (2) water-jacketing the exhaust line and connecting it as a temperature booster in series with the jacket-water system, or (3) water-jacketing the exhaust line and using it to heat water in a circulating system separate from the engine-cooling-water system. These methods are all covered in "The Gas Engine Handbook," published by the American Gas Association, 420 Lexington Ave, N. Y., and reviewed in POWER, February, 1940.

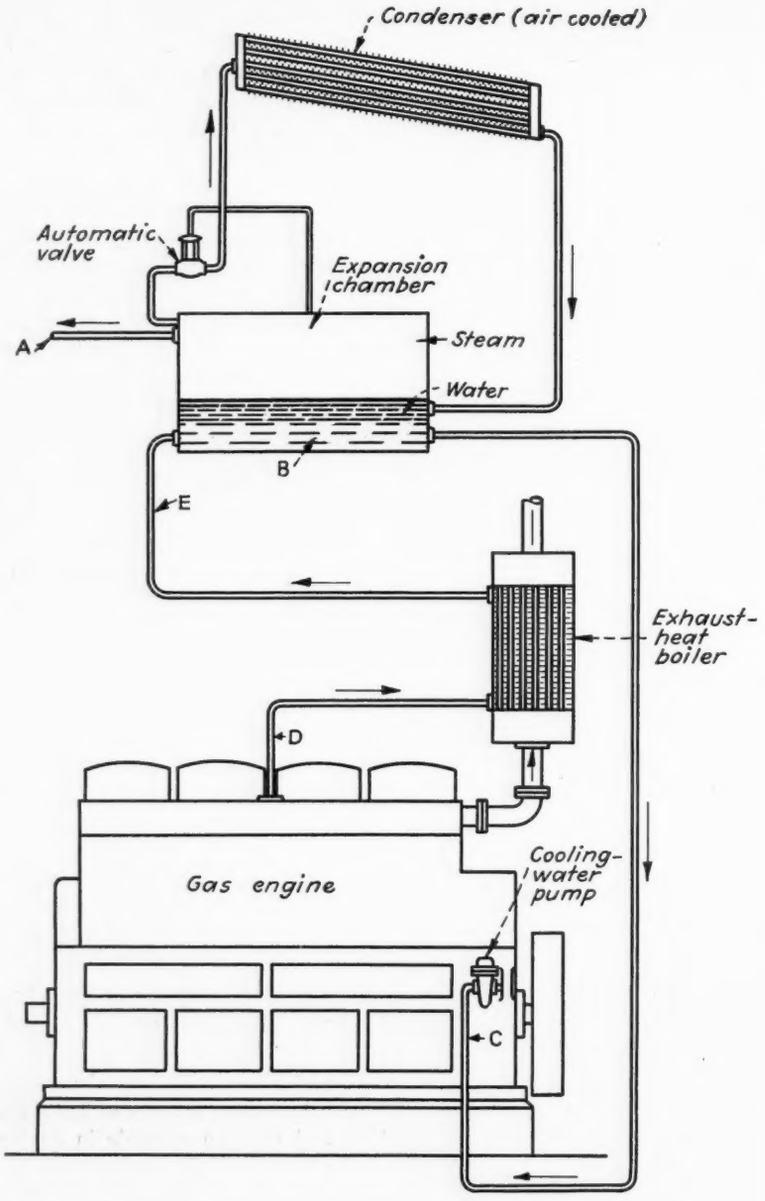
Reporting on "high-temperature" cooling, D W Reeves, Oklahoma Natural Gas Co, Chairman of the AGA Gas Engine Power Committee, says "Because of the fact that engine jacket water is generally maintained at temperatures under 200 F, it has been difficult to use such water directly, without additional heat being supplied from some source outside the engine.

Experimental Work

"Experiments have been carried on during the past few months in Southern California, following several years of development work abroad, in the high temperature cooling of internal-combustion engines. By 'high temperature' cooling it is meant that instead of maintaining jacket-water temperatures of approx 160 F, the temperature is raised to 215 F and over. In some instances, temperatures of jacket water of from 300 to 400 F have been tried. However, at these higher temperatures, lubrication difficulties have been experienced. At the lower temperatures, from 220 to 250 F, no mechanical difficulties have been encountered."

The report goes on to indicate the wide range of industrial uses for waste heat at temperatures of 212 F and over, and cites an example in an ice plant with ammonia compressors powered with gas engines. Assuming an ice-making capacity of 40 tons per 24-hr day, such a plant would have a 100-hp gas engine, operating at 70 lb brake mean effective pressure, cooled with jacket water at 220 F, and carrying an exhaust temperature of 950 F. Approximately 250,000 Btu per hr will be available from jacket water, and 227,500 Btu per hr available from the exhaust, using a waste-heat boiler of 65% efficiency.

If the waste heat operates one of the new absorption refrigeration units using methylene chloride for refrigerant and dimethyl ether or tetraethylene glycol as solvent, ice-can water and liquid ammonia can be pre-cooled, producing a 25% power saving per ton of ice made. If the existing suction temperature is above the minimum operating point, the plant efficiency may be increased by about the same amount (25%), without increasing gas consumption, by the simple device of boosting compressor



TEMPERATURE AT VARIOUS POINTS AT DIFFERENT STEAM PRESSURES

Steam pressure, lb g	Temperature F				
	A	B	C	D	E
1	216	216	215	224	231
2	219	219	218	227	234
3	222	222	221	230	237
5	228	228	227	236	243

speed, thus lowering brine temperature.

First cost of ice-plant capacity averages about $1000 per ton. Using the arrangement just outlined, capacity can be increased 25% at a cost of about $200 per ton for the additional output.

As an added advantage, high-temperature cooling gives automatic control of the engine heat balance not possible with conventional cooling. For example, with jacket water held at 160 F by circulating 50 gpm, there will be times when there is no use for the heat in the full 50 gpm, and water temperature will rise. In other words, when engine temperatures are kept below the boiling point, jacket heat must be removed at a uniform rate or temperatures will fluctuate so as to cause operating difficulty. For the same reason, it is difficult to hold the desirable 20-F temperature differential between inlet and outlet water. With high-temperature cooling, all or any part of the heat may be abstracted without upsetting the engine heat balance.

The diagram shows a high-temperature cooling hookup where a condenser, either atmospherically or fan cooled, may be installed on the roof. The expansion chamber holds water at 212 F, part of which flows to the main cooling-water circulating pump. By the time the water enters the engine, the temperature has dropped to about 211 F; this will rise to about 220 F in circulating through the engine. Passage through the exhaust-gas heater raises the temperature to 227 F. This 227-F water mixes with the 212-F water in the expansion chamber, cooling down to 212 F and liberating steam. This steam may be used for any indirect heating operation.

An automatic valve in the condenser connection opens when steam pressure exceeds by a lb or two the pressure desired in the supply line, as would be the case if steam requirements should fall off. Excess steam goes to the condenser and condensate returns to the expansion chamber.

Since atmospheric-pressure steam is not sufficient for most plant needs, the table at left gives the temperatures at various points in the system, for pressures of 1 to 5 lb.

Applications

Adaptations of this basic scheme can be worked out to fit many conditions. For tank water heating, jacket water or steam from the expansion chamber may run directly to a heat exchanger in the water tank. Where the problem involves space heating, unit heaters or condensers may be installed wherever heat is needed, and jacket water or steam may be piped to and from the heating units. If warm air is desired from gas-engine "waste heat," there is no need to install, near the engine, condensers equipped with blowers or fans. Piping the steam or water close to the point of warm-air application will eliminate costly duct work, and probably reduce transmission losses. Power for the circulating pump will be offset by savings in blower power.

The high-temperature method of cooling natural-gas engines makes available 4–5 lb of steam at 230 F for every brake hp developed by the engine. For example, a 120-hp engine driving, at full load, a 75-kw generator would yield about 480 lb of 230-F steam for auxiliary heating.

12 Years of Hydrogen Cooling

AT THE AMERICAN INSTITUTE of Electrical Engineers winter convention, held in New York, N. Y., Jan. 22–26, Philip Sporn and F M Porter gave results of 12 years operating experience with hydrogen-cooled synchronous condensers and alternators on the American Gas & Electric Service Corp power systems.

The paper dealt particularly with seven synchronous condensers of 161,000 kva total capacity in seven plants. These units have operated a total 58.44 machine-years and have been out of service less than 4% of the time for inspection and maintenance. They have been actually operated for over 90% of the time.

The machines have been out of service due to hydrogen construction only 1.2% of the total time since installation. Satisfactory operation is also reported for a 50,000- and a 66,667-kva generator operating in hydrogen.

Conclusions

From experience with these machines, the authors reached these conclusions:

1. Construction for operation in hydrogen is one of the minor factors adversely affecting machine availability. The fact that two machines have each been operating for over two years with no direct supervision indicates that the reliability is as great or greater than that of air-cooled units.

2. From an economic standpoint, gas consumption is an almost negligible item. The cost of hydrogen used is generally less than 5% of the savings obtained by reduction in windage losses.

3. Accessories required for operation in hydrogen have introduced no complications of any significance.

4. From a safety standpoint, there has appeared no reason for concern when the machine is normally operating in hydrogen.

5. More than 45 machine years of outdoor operation, involving five machines during all possible weather conditions, demonstrate the adaptability of this apparatus for such service.

6. General inspections every five years have been found sufficient.

7. Field tests have demonstrated that, in general, the air-cooled capacity of a given synchronous condenser can be increased 25% by the utilization of hydrogen, at slightly above atmospheric pressure, and still further augmented an additional 20% by raising the gas pressure to 15 lb per sq in.

8. When designed for gas pressures up to 15 lb per sq in., reliable performance can be obtained at such higher pressures, and advantage taken of the additional cooling effects of a hydrogen atmosphere.

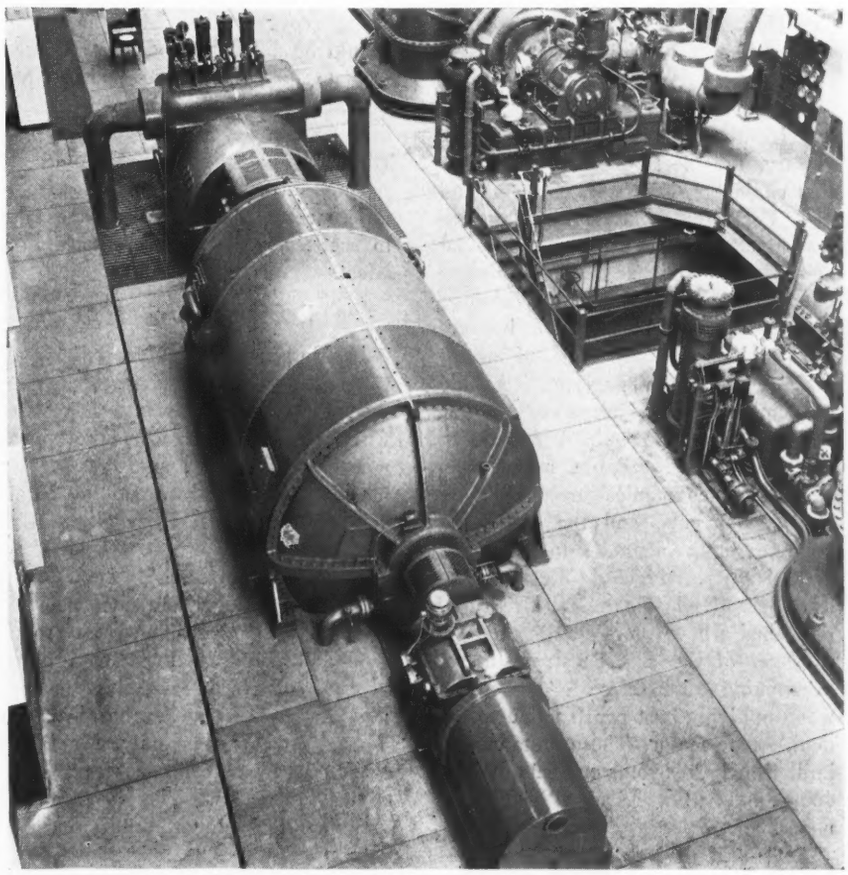
9. The utilization of hydrogen, particularly at pressures above atmospheric, permits not only the carrying of additional continuous loads, but also allows heavy swings of short duration with entire safety because of the ability of hydrogen to rapidly and efficiently remove heat from possible hot spots in the windings.

10. The condition of the windings, particularly in the machines which have been in service for over seven years, affords every reason for anticipating insulation life considerably greater than is now obtained from units exposed to the injurious effects of oxidation and corona, when operated in air.

11. It seems clear, to the authors at least, that the hydrogen-ventilated synchronous condenser is more economical for units above 10,000 kva than the equivalent air-cooled machine. The future offers possibilities of higher voltage and further development of 3600-rpm alternators to take maximum advantage of hydrogen cooling.

12. Although tests seem to indicate that increases above 15 lb per sq in. do not produce correspondingly proportional gains in cooling or capacity, operation at gas pressures above this level should, and undoubtedly will be, explored.

13. Hydrogen cooling permits construction of large, high-speed turbine generators, which could not be properly cooled by air at all, or in some sizes only by utilizing external fans. By going to hydrogen a more compact design results, which, combined with savings from reduced windage losses, more than balances the cost of explosion-proof construction and accessories necessary for operation in hydrogen.



Looking at the 66,667-kva, 3500-rpm hydrogen-cooled turbine generator from collector-ring end, in Windsor plant of the Ohio Power Co

Refrigeration and Air Conditioning Move Ahead

Highlights of the annual ASRE and ASHVE meetings: developments in squirrel-cage motors, ultra-violet to kill bacteria in air, new data on glass block, insulations, filters, ducts

CLEVELAND, JAN. 25—The closely related refrigeration and air-conditioning fields held the center of the technical stage in January, with the American Society of Refrigerating Engineers meeting in Chicago January 17-19 and with the American Society of Heating and Ventilating Engineers gathering in Cleveland January 22-25. To further spotlight these industries, the Refrigeration Equipment Mfrs Association staged the 2nd All-Industries Exhibit during the week of the ASRE meeting, and Cleveland's famed Lakeside Hall housed the 6th International Heating and Ventilating Exposition.

New Rotor

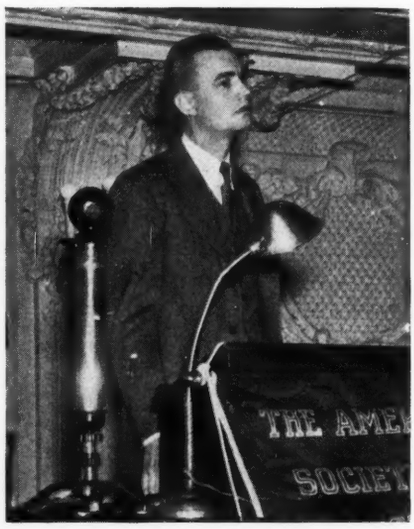
Celebrating the Society's 35th anniversary, the meeting of the refrigeration engineers dealt with both old and new. For the new, C C Leader, General Electric Co, told of recent developments in squirrel-cage motors. Pointing out that growth of air conditioning and commercial refrigeration brought the problem, in many cases, of installing large motors in congested areas and on combined light and power circuits, he showed how the squirrel-cage motor, low in cost and reliable, might meet the power companies' need for low starting currents, and the equipment maker's requirements as to price and serviceability. Tracing the development of squirrel-cage design, Mr Leader described a new rotor retaining the advantages of the cast construction but overcoming difficulties formerly met when applying cast construction to the double-cage motor. These units can be built with locked-rotor currents of 350–400%, and will meet special installation needs.

Advent of the "condensing unit" as a competitive mass-production item has forced engineers to concentrate on the condenser and to abandon empirical design methods, according to Henry B Pownall, York Ice Machinery Corp. Presenting a method of analysis of condenser performance based on a single tube, he discussed effect of such factors as water-pressure drop, tube diameter, quantity of water per ton, length of travel, scale formation, and gave rating curves for tubes of various sizes and for different refrigerants.

Based on this method of analysis, Mr Pownall suggested the following rules for general condenser design: (1) fixed unit areas cannot be determined for all types of surface, but the loading should be a function of the type used, (2) to obtain best condenser performance, use as high a water-pressure drop as can be economically justified, (3) terminal difference should be selected on the part of the curve where differences in heat-transfer values, due to scale, for example, will have little effect.

Refrigeration's Future

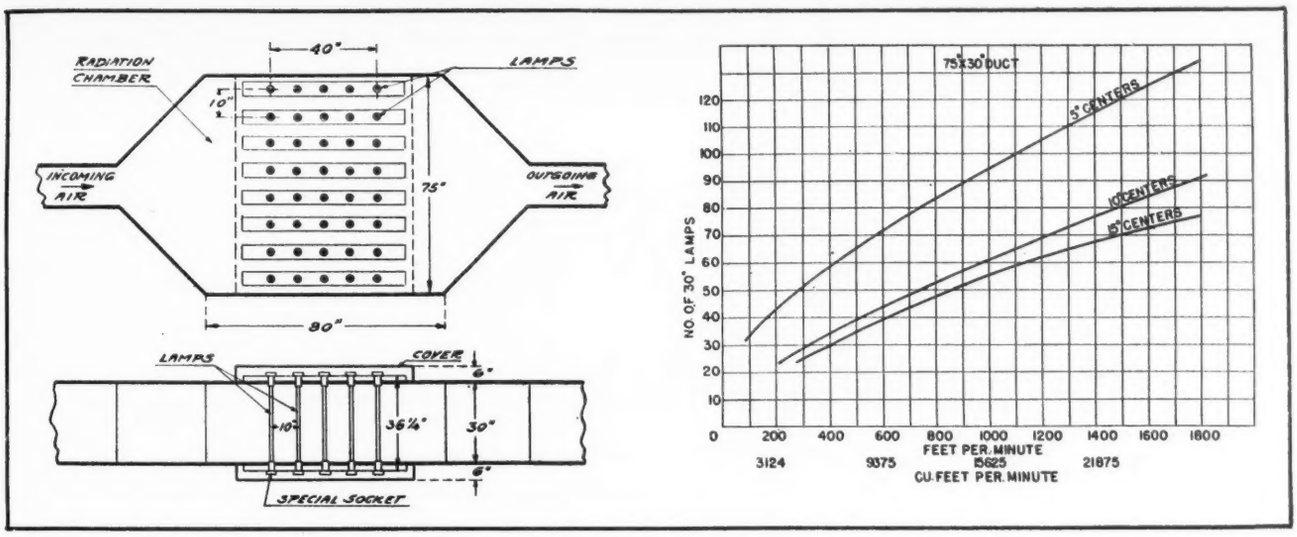
Looking into the future, S C Bloom, Chicago consulting engineer, tackled the job of predicting what refrigeration will be like in 1954, when the Society meets for its golden anniversary. Remarking the steady trend to higher compressor speeds and smaller cylinders, he saw wider use of centrifugal compressors, particularly down into the smaller sizes, where such machines will meet competition from rotary types. With the cooling-water problem growing more acute, and with the cooling tower and the evaporative condenser as stop gaps only, Mr Bloom felt the utimate solution was the air-cooled condenser. This in turn may stimulate development of new and more suitable refrigerants, but nothing now threatens ammonia, and Freon is likely to hold its own, as is SO_2. On the other hand CO_2 seems on its way out.



C C Leader, General Electric Co, describes new squirrel-cage rotor with cast double winding

In cold storage, the trend away from ceiling coils means almost entire dependence on convection. But the speaker seemed to think that growth of panel cooling might bring radiation back into the picture. For the next 15 years, air conditioning will be the biggest field for refrigeration, with application of self-contained store units growing until buildings are more generally supplied with central systems. Residence cooling still looks dubious on any large scale.

Other possible future developments include: quick-freezing done right at the fishing grounds, and expansion of the ice industry with emphasis on special forms such as flakes, blocks, cubes, etc, and with increased use of ice in air conditioning of churches, theatres, and other low-load-factor installations. Looking back into the Society's 35-year history, and beyond, David L Fiske, Secretary, brought to light many interesting technical and



Arrangement of ultra-violet lamps in air duct. Chart shows number and spacing for various air flows

human sidelights of the early days of refrigeration.

In an informal conference on corrosion, a paper written by Logan L Lewis, Carrier Corp, told of trouble encountered with bacterial growths in air conditioning and refrigerating systems, and went on to discuss the general corrosion problem. Several engineers pointed out that bacterial action is a scale problem rather than corrosion, and outlined various means of treating to prevent bacterial growths. B E Tiffany, Norge, gave a clear picture of the difficulties in trying to match laboratory tests of corrosion resistance and field results. Both he and Dr H M Elsey, Westinghouse, described laboratory procedures for measuring rate of corrosion of various materials exposed to refrigerants. Discussion centered on the role played by lubricating oil in refrigeration corrosion and on the problem of "electro-plating."

Ultra-Violet Rays

Long known to have bactericidal properties, recent developments in ultra-violet technique make it practical to use such radiations for killing airborne organisms, according to a paper presented to the ASHVE meeting by Harvey C Renstchler and Rudolph Nagy, Westinghouse. Extensive experiment shows that killing action depends on total radiation to which bacteria are exposed, regardless of whether it is a high intensity for a short time or a low intensity for a longer time. Tests also show that there is no difference in bactericidal effect over a range of humidity from 35 to 95% or over the usual range of temperature encountered in air conditioning.

Ultra-violet radiation can be applied by exposing air in a room to direct radiation, requiring protection against direct exposure by the occupants; a semi-direct system may be used with air in the part of the room not directly occupied being irradiated while other parts are shaded from direct rays; ultra-violet lamps may be placed in the ducts of air-conditioning systems, exposing all recirculated air to the radiation as it approaches and passes the lamps. The sketch shows such a duct installation, and the chart gives spacings for a 75x30-in. duct. Charts for different duct sizes have been worked out.

Insulation

In line with the Society's program of adding to the information available on the heating and ventilating art, numerous papers presented results of research work carried out by the Society's own research staff or by cooperating groups. In a paper "Heat Gain Through Glass Blocks by Solar Radiation and Transmittance," F C Houghten, David Shore, H T Olson, and Burt Gunst, of the ASHVE Research Laboratory, described methods used in testing glass block and outlined results to date; this work will be continued. Further data on properties of materials was supplied by G B Wilkes, MIT; F G Hechler, and E R Queer, Penn State, whose tests on aluminum-foil insulation demonstrated the fact that conductance of an air space faced with reflective surfaces varies with the temperature difference, and that direction of heat flow is important.

Studies by F B Rowley and R C Jordan, University of Minnesota, developed data on the kind of lint found in air, and its effect on the life and dust-holding properties of filters. Results are that lint tends to increase the arrestance slightly, that its effects are greatest on filters whose capacity depends on distribution of dust throughout the depth. Also, that filters with large surface areas for holding dust on the surface of the filtering medium may not be seriously affected, and, finally, that lint has a dominating influence on performance characteristics and should be considered as an element in the standard dust used for rating filters.

Checking the effect of approach on the discharge from air openings similar to those used in rooms, D W Nelson, D H Kraus and A F Tuthill, University of Wisconsin, found that in most cases air left at a slight angle with the horizontal and an area of reverse flow was found in the lower section of the face opening. The highest pressure drop was found with the square-throat rounded-back type, while the drop for square types was only slightly less. Addition of inner radii decreased drop, as did use of splitters in stack heads of short radii and turning vanes in square ones.

Analysis of friction-flow data by J B Schmieler, F C Houghten, and H T Olson, ASHVE Research Laboratory, led to the conclusion that a velocity exponent of 1.83 (instead of the 2 commonly used) applied to the modified Fanning formula gives results which check test data closely.

In another analytical paper, John McElgin and D C Wiley, John J Nesbitt, Inc, presented a rational and convenient method of anticipating the area of fin and tube surface required to remove from air a specific total heat quantity in which both latent and sensible heat are transferred. This method simplifies former difficulties by permitting required area to be determined directly as a function of the mean difference between the total heat of the air and the total heat corresponding to saturation at surface temperature.

Well water deposited tons of scale in condenser tubes. After struggling for years with drilling and acid cleaning, plant tried hexametaphosphate, 1.0 to 1.5 ppm. Scale disappeared

Station K Wins Battle Against Condenser Scale

By JOHN O OLSON
Chief Engineer of Plants,
Iowa-Nebraska Light & Power Co

K STREET HAS two 7425-sq-ft, radial-flow, steam surface condensers, also four surface-type inter- and after-condensers on air ejectors, two air coolers and four oil coolers. All use cooling water out of one system. Each main condenser has 2100 tubes, ¾-in. OD, No. 18 gage, 18 ft, 3 in. long. Cooling water circulation is 16,000 gpm.

Two wooden forced-draft towers cool the water in this recirculation system and two deepwells supply water to make up windage and evaporation loss and provide enough overflow to keep the concentration of solids within reason. We are advised by the company that developed the present treatment that far less overflow or blowdown would be necessary with a better quality of water than that furnished by K-Street wells.

Each well can deliver about 750 gpm, but one can handle the makeup load in cold weather. Only one well is necessary to keep down concentration, but the second well is run in hot weather to help keep down the temperature of cooling water.

The extremely poor quality of this well water will be obvious from the accompanying analysis, which shows a huge content of sodium chloride (common salt) plus a substantial amount of scale-forming elements, of which the calcium compounds are particularly bothersome.

As might be expected, a very hard, stone-like scale began to form in the condenser tubes almost immediately after the plant went into operation about 10 years ago. The same trouble occurred in the ejector condensers, air coolers and oil coolers, but to a lesser extent.

Mechanical tube cleaners gave indifferent results. Tube drilling was slow and the tubes were frequently damaged by drills deflected into the metal by the hard scale.

Muriatic acid solution was the next remedy tried. Results were "so-so." In the earlier trials the acid did a fairly good cleaning job in the lower tubes, but hardly touched the scale in the upper tubes, and this in spite of the fact that the condenser was filled, at the start, with a 10% acid solution.

What happened was this: Gas, rapidly generated by the chemical action of the acid on the scale, filled the upper tubes and blocked off the solution from that part of the condenser.

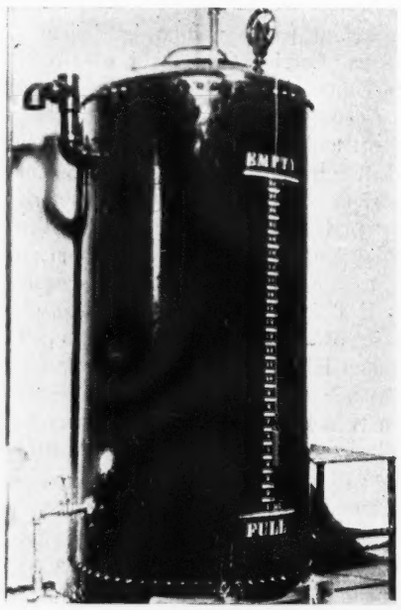


Fig. 1—For phosphate feeding, mixing, this tank was reclaimed from scrap pile

To cure this we installed a few vents and connected them all to a temporary overhead separating tank designed to give a static head of about 10 ft on the top tubes. This got rid of the gas and insured equal action of the acid on the upper and lower tubes.

The acid solution was circulated at the rate of about 200 gpm. To tell when to stop the treatment, we kept titrating the acid solution with a sodium hydroxide solution of known strength and plotted the results against time. The flattening out of the curve showed when practically all of the scale was out of the tubes.

This improved method of acid cleaning gave fairly good results on 90% of the tubes, but failed on the remain-

ANALYSIS OF WELL AND TOWER WATER

	(1) *grains per gal*	(2) *grains per gal*	(3) *grains per gal*
Total solids	1870	2244.4	2323.9
Soluble solids	1816	2242.0	2315.0
Organic matter	5.1	2.4	8.9
Bicarbonate ($CaCO_3$)	21.7	23.4	23.5
Carbonate ($CaCO_3$)	None	None	None
Hydroxide (OH)	None	None	None
Sulphate (SO_4)	121	136.6	138.7
Chloride (Cl)	1081	1238.0	1241.0
SiO_2	7.1	5.5	2.7
Calcium (Ca)	21.6	25.1	25.2
Magnesium (Mg)	10.7	12.0	11.9
Sodium (Na)	712	826.0	830.0

(1) Well water, August 8, 1939
(2) Cooling-tower water, August 8, 1939
(3) Cooling-tower water, June 7, 1939

ing 10%, because loose pieces of scale clogged the tube inlets. A backwash connection on the circulating water line overcame this difficulty.

With this method, or any other, "how often to clean" is a matter of economics. We kept a close daily check on heat transfer and balanced the cost of cleaning against the cost of loss of plant efficiency from the progressive decrease in vacuum between cleanings. From this we figured that each condenser should be cleaned at least once every 60 days.

Yet, even with this most economic timing, the combined cost of acid, labor and time unavailable was heavy. The acid also had a somewhat detrimental effect on the tube metal and a decidedly bad effect on the metal of the condenser waterboxes. We were forced to retube both condensers after about eight years of this kind of service.

We decided to give it a try, although both we, and the salesman who made the suggestion, were very skeptical because the other condenser experiments had been made with water not as heavily salted and scale-forming.

Little in the way of positive results was evident during the first 60 days of application of hexametaphosphate, although we could see that no more scale was forming and that the previously deposited scale (a heavy accumulation) was loosening and dropping off in the cooling tower. Before long, several tons of accumulated scale dropped down into the tower basin and had to be shoveled out to prevent trouble. The small pieces of this old scale were carried in the circulating water and frequently clogged the inlet end of condenser tubes. We removed these by backwashing, using a counterflow strong enough to dislodge the pieces from the tube ends and flush them through the special discharge outlet.

We have now been using hexametaphosphate since April, 1938, and all our tubes are still clean. Practically all of the accumulated scale in the cooling tower has disappeared, and no new scale has formed anywhere.

Shortly after we started to use the hexametaphosphate the weather became warm, and a slimy coat (an algae growth) started to form in the condenser tubes. To counteract this we at first tried potassium permanganate. This partly checked the growth, or at least changed the color of the algae, yet it did not satisfactorily remove the slime. Next we tried chlorine gas, with real success, and are still using it to prevent algae growth.

Our standard practice today is to maintain from 1 to 1.5 parts per million of hexametaphosphate continuously in our circulating water, and to use from 2 to 5 lb of chlorine gas per day, depending upon the temperature of the atmosphere and of the circulating water. We have shot rubber plugs through the tubes in one condenser a few times to clean out algae, but no acid cleaning has ever been necessary in either condenser, nor in the cooling equipment, since we started the use of hexametaphosphate.

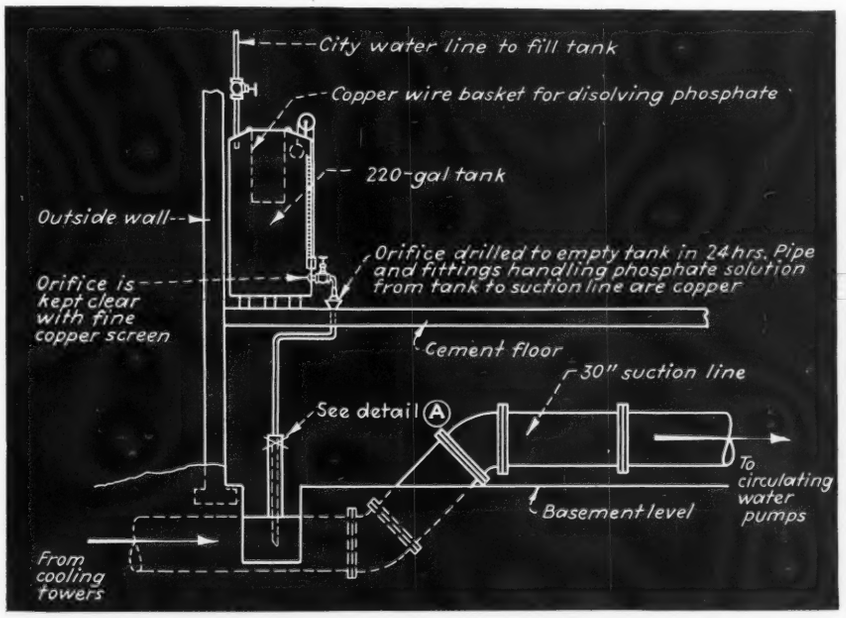

City water line to fill tank
Copper wire basket for disolving phosphate
220-gal tank
Outside wall
Orifice drilled to empty tank in 24 hrs. Pipe and fittings handling phosphate solution from tank to suction line are copper
Orifice is kept clear with fine copper screen
Cement floor
30" suction line
See detail A
To circulating water pumps
Basement level
From cooling towers

Fig. 2—Feeding arrangement maintains from 1.5 to 2 ppm of hexametaphosphate in condenser circulating water. See sketch at right for detail of feeder pipe

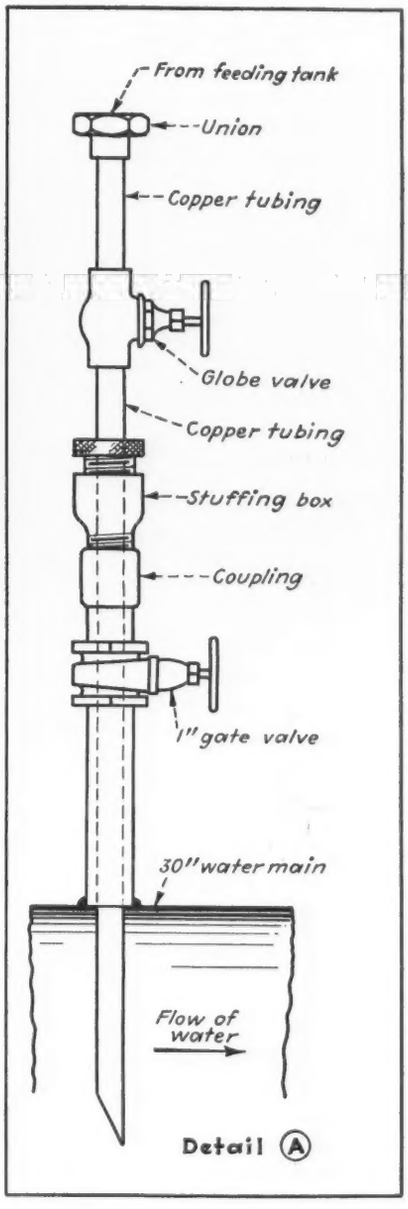


Fig. 3—Detail *A* of feeding arrangement, Fig. 2. Copper tube can be pulled up just above gate valve. Then close valve and lift out tube without danger of drawing air into water main

It became increasingly clear that acid-cleaning, while workable, was far from a satisfactory solution of our scale troubles. About 20 months ago my associates and I went after this problem in earnest, hoping to find some better way to remove or prevent scale.

In March, 1938, a salesman whose firm was then supplying us with sodium hexametaphosphate for boiler use told us that certain industries were using this material in concentrations of only 1 or 2 parts per million to prevent the deposition of calcium-carbonate scale from process water. This man also told us that some utilities were using the same substance to prevent scale formation in condenser tubes.

Speaking of Power

Useful articles don't "happen"

I hope a lot of readers are following the water-analysis series now running on the "How to" pages of The Operating Engineer (page 109 in February, page 105 in this number, concluding installments in April and May) . . . Let me tell you a little about the history of this series just to demonstrate that useful articles don't just happen. For years we have been conscious of a persistent reader demand for brass-tacks information on water analysis and treatment. This has been hard to get, because only the chemists have the facts and they generally don't talk our language. . . .

Late in 1939 I proposed to L D Betz of Philadelphia a cooperative program in elementary chemical education. I told Mr Betz that I would like to show our readers how to conduct a simple water analysis. I

Editor's hours save minutes

wanted the instructions made so crystal clear that no reader could miss the point. . . . Mr Betz agreed to cooperate to the limit. He shipped a test outfit to our photo lab in New York and personally instructed us in its use. Then Associate Editor "By" Sawyer peeled off his coat and ran right through the analyses under the spotlight, while our photo expert, Jerry Moran, snapped every step, 29 in all. . . . Descriptive text, based on instructions prepared by Chief Chemist C A Noll of Betz, was rewritten and double checked until every step was made as clear and simple as possible.

Articles produced in this fashion are the hardest to write, but the easiest to read. Since there are thousands of readers to every editor, we claim that the editor should work an extra hour to save the reader a minute. . . . Please note that these water-testing articles are not propaganda for any particular method of treating water. They are merely a streamlined presentation of standard water tests and apply to any system of treatment.

I learned a bit about diesels during a recent trip to Rochester, N. Y., from men who are running them. There is no simple answer to the question "Is the diesel a reliable prime mover?" It's like asking "How long is a piece of string?" . . . It all depends on the string and the diesel. There have been plenty of examples of serious trouble where a diesel selected was unsuited to the particular load, fed with the wrong fuel or improperly lubricated and maintained. But just as truly the diesel has proved itself a most reliable machine, as well as a fuel saver, where it was picked right and handled right. . . . Since diesel operation seems to be 90% horse sense and mechanical experience and 10% theory, we plan to devote more and more of our diesel space in POWER to the problems of maintenance and operation.

Also, while in Rochester, I had the pleasure of presenting my ideas on practical education to the locals of the International Union of Operating Engineers, the National Association of Power Engineers and the Universal Craftsmen Council of Engineers. . . . I had been through the Kodak Park plant

Operation 90% horse sense

before, but J H Cather, head of the Power Div, reminded me that refrigerating capacity is 14,000 tons, that prime mover capacity is 28,000 kw plus 20,000 hp of mechanical drive, that the maximum steam-generating capacity is 1,040,000 lb per hr. . . . Altogether, Eastman Kodak has 2600 men in the engineering and maintenance department, and 308 apprentices of all sorts. . . . All this seems impossible until you remember how many people go to the movies and that Eastman makes about 90% of all the movie film used in America.

Several readers have written in during the past two years asking us why we omit periods after abbreviations. Most of the letters express curiosity rather than ire and we have been meaning for some months to explain ourselves. To go back to the beginning, in 1932 the American Standards Association published a standard list of abbreviations for scientific and engineering terms, in which periods were omitted except in cases where such an omission would result in an English

We hack out periods

word. For example, they recommended kva, not k.v.a.; kwhr, not kw.hr.; but in. for inch because without the period it becomes a preposition. . . . After a lag of 5 years, in which we were thinking this thing over, we put ASA's recommendations into effect, and went them one better by omitting periods after all abbreviations, initials, society names, etc. . . . So far, as we said before, nobody has complained that we were making the English language harder to read; they were just curious. However, if there are readers who really don't like this business of omitting periods, we wish they would tell us so. Meanwhile, we go along hacking out periods our printer insists on putting in for us, even though they do not appear in the manuscript. That's why, once in a while, you will find a period sticking out like a sore thumb in a page otherwise barren of little black dots—that one got by us.

Looking ahead a bit, I plan, shortly after attending Chicago's Midwest Power Conference in April, to make an automobile tour of the textile and

Going South in the Spring

other plants of North Carolina. Nice country down there, particularly in the spring! From past experience, I know I shall find lots of good power plants, competent engineers and useful ideas—*Phil Swain.*

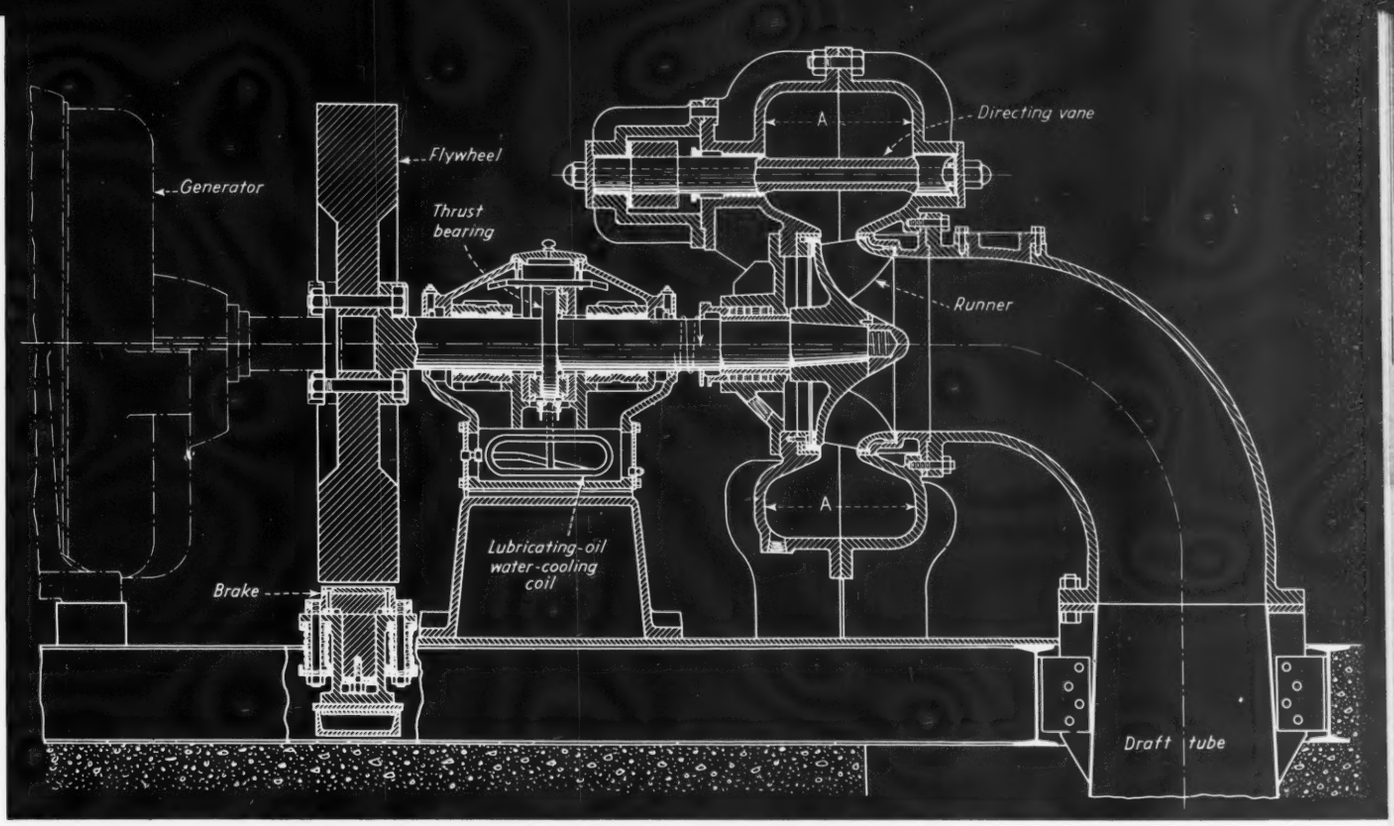


Fig. 1—Cross-section through hydraulic turbine, Fig. 3, now being installed to operate under a head of 190 ft

Space-Saving Hydro Turbine

AT THE BARRIE-BROOK hydroelectric plant of the Nova Scotia Power Commission there is being installed a 500-hp, 900-rpm, 190-ft head Reiffenstein turbine, built by the Dominion Engineering Works, Ltd. This horizontal-shaft unit connects to a 450-kva generator, with a flywheel between the two, Fig. 1. The turbine, similar to a Francis type without wicket gates, was named after its inventor, Dr Manfred Reiffenstein, of Vienna, Austria, and is a comparatively new development.

A single directing vane in the casing intake, Fig. 2, controls flow to the runner. When closed, this vane makes contact at its downstream end with the outer wall of the casing and at its up-stream end with the tip of the casing baffle. Central cones on each side of the casing form the water passage into the runner.

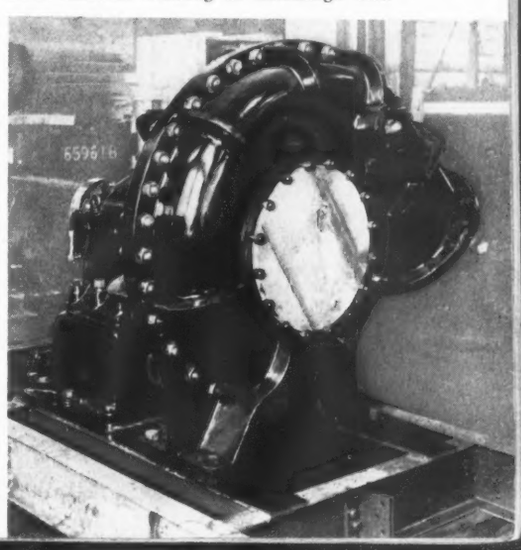
Except for the cones, the casing has uniform dimensions axially, that is, dimensions *A* at top and bottom of the casing, Fig. 1, are equal. This permits proper confluence of flow at the casing baffle to suit the rectangular form of the directing vane.

Because the directing vane is near the casing entrance where water velocity is lower than near the runner, it has been found that higher velocities can be used in the scroll case than on a conventional turbine, without impairing efficiency. This factor, and omission of the guide vanes, results in appreciably smaller over-all dimensions than for a conventional design of equal output and speed.

Use of this turbine is in general limited to small- and medium-size units where the saving in number of parts and machine work reduces the cost of the unit below that of a conventional design. Advantages claimed for this type of turbine, where it is applicable, are reduction on first cost, smaller dimensions, with a consequent saving in space, lower operating cost, and less danger of clogging with ice and debris.

Fig. 2—One-half of scroll-case showing single directing vane in scroll-case entrance

Fig. 3—Assembly of 500-hp, 900-rpm, Reiffenstein turbine looking at discharge end



Burn Midwestern Coals

THE OHIO SALT COMPANY installed a 120,000 pound per hour Riley Steam Generating Unit during 1939. Since Ohio coals were to be burned it was decided to fire the unit with a Riley-Harrington Traveling Grate Stoker. The unit is doing an excellent job of burning Ohio coals; is operating at an efficiency of 85.3% when producing 121,000 pounds of steam per hour though guaranteed efficiency was only 83.3%. Indicative of the plus values of Riley equipment.

Smokeless Combustion

Due to the difficulty experienced at many installations where Ohio coal is burned, the Ohio Salt Company's engineers demanded a guarantee that when "burning the fuel specified, the color of the stack gases will conform to Ringelman's chart No. 2 at all ratings specified." The Riley Unit met this requirement entirely satisfactorily as well as all other performance requirements.

Duplicate Unit Ordered Because of Satisfactory Performance of First Unit

The first Riley Unit was placed on the line operating up to ratings of 65,000 pounds of steam on natural draft on September 25. On September 30, draft equipment was started up and the unit operated up to maximum guaranteed capacities. On October 7 the unit was shut down for internal inspection. As no adjustments or changes were required, the unit was again placed on the line and acceptance tests were conducted, November 1, 2 and 3.

The Ohio Salt Company was so well satisfied with the ease with which this unit was placed on the line, with the excellent operating results and the general construction and appearance of the unit that on November 15 they placed an order for a duplicate unit without competition.

It is because of equally satisfactory results from installation after installation of Riley Boiler and Fuel Burning Equipment that the swing continues so definitely to Riley Equipment . . . why within the past few months, two of the country's largest public utility companies have placed orders for 300,000 pounds per hour Riley units . . . why Riley was awarded the order for the largest steam generating unit in the steel industry . . . why it will pay you to visit modern Riley installations before purchasing boiler or fuel burning equipment.

RILEY

STOKER CORPORATION, Worcester, Mass.

Boston New York Philadelphia Pittsburgh Buffalo Cleveland Detroit Tacoma
Baltimore St. Louis Cincinnati Houston Chicago Milwaukee Denver
Memphis St. Paul Kansas City Los Angeles Atlanta New Orleans

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs.

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS
AIR HEATERS • ECONOMIZERS • WATER-COOLED FURNACES
STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

It will pay you to visit modern Riley Installations

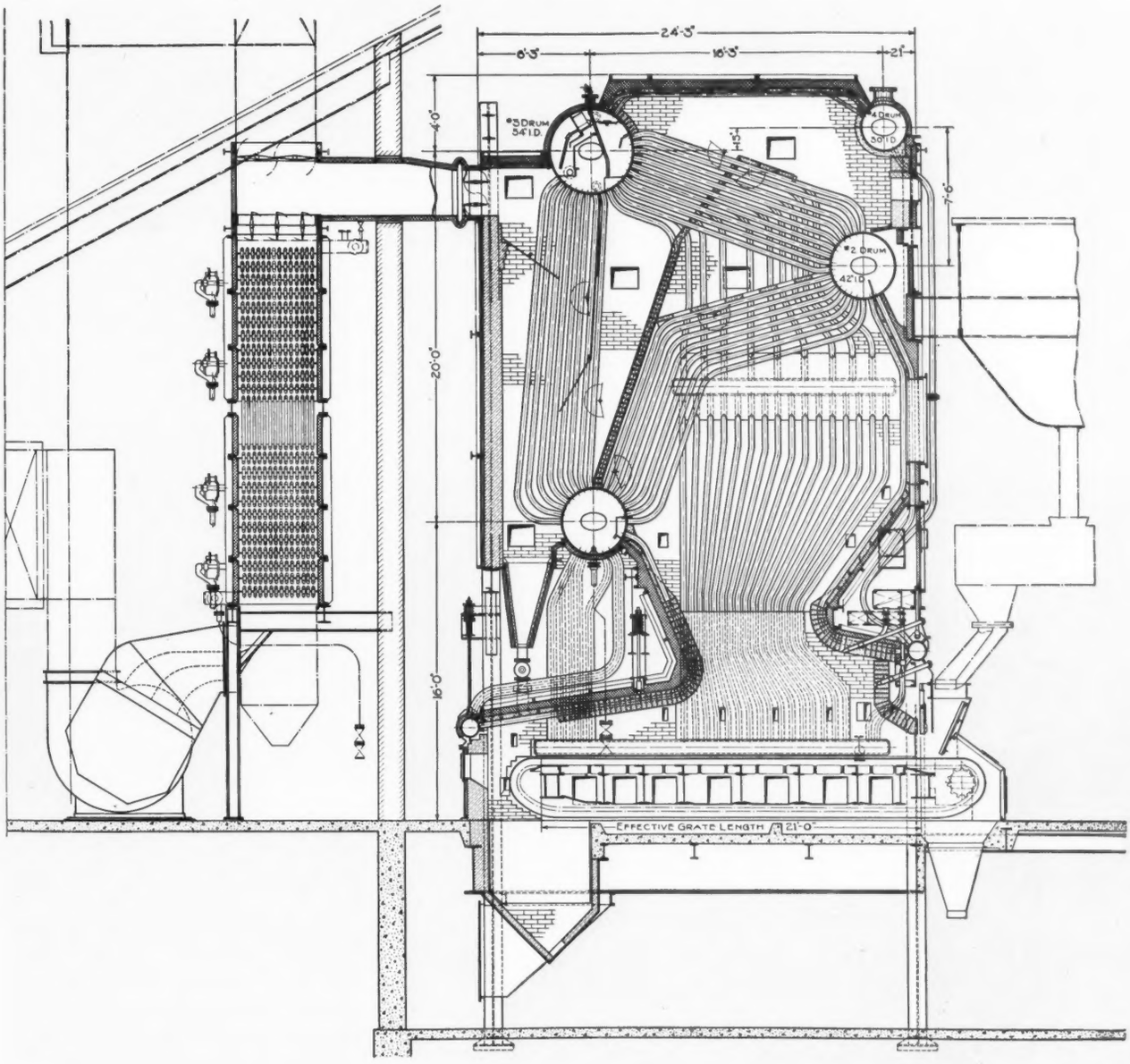
here is a job that does it mighty well–

comparison of actual results and guaranteed performance

	Actual Results	Guaranteed Performance
Pounds of steam per hour, Actual Evap.	121,000 lbs./hr.	120,000 lbs./hr.
Temperature, economizer exit gases	399°F.	400°F.
Temperature, water entering econ.	223°F.	225°F.
Temperature, water leaving econ.	309°F.	307°F.
CO_2	14.15%	13.5%
Efficiency	85.3%	83.3%

Typical Coal Analysis	
Moisture	5.77%
Volatile Matter	39.4%
Fixed Carbon	47.4%
Ash	7.43%
Sulphur	3.19%
B.T.U. as fired	12,790 B.T.U.

OHIO SALT COMPANY, Rittman, Ohio
120,000 lbs./hr. Riley Boiler Unit
equipped with Riley Water-cooled Furnace, Riley Economizer, and Riley Steel-clad
Setting fired by Riley-Harrington Traveling Grate Stoker
H. M. Wilson Company, Philadelphia, Penna., Consulting Engineers



before purchasing Boiler or Fuel Burning Equipment

Runner for Hiwassee turbine weighs 95,000 lb and will develop 80,000 hp

More Power for TVA

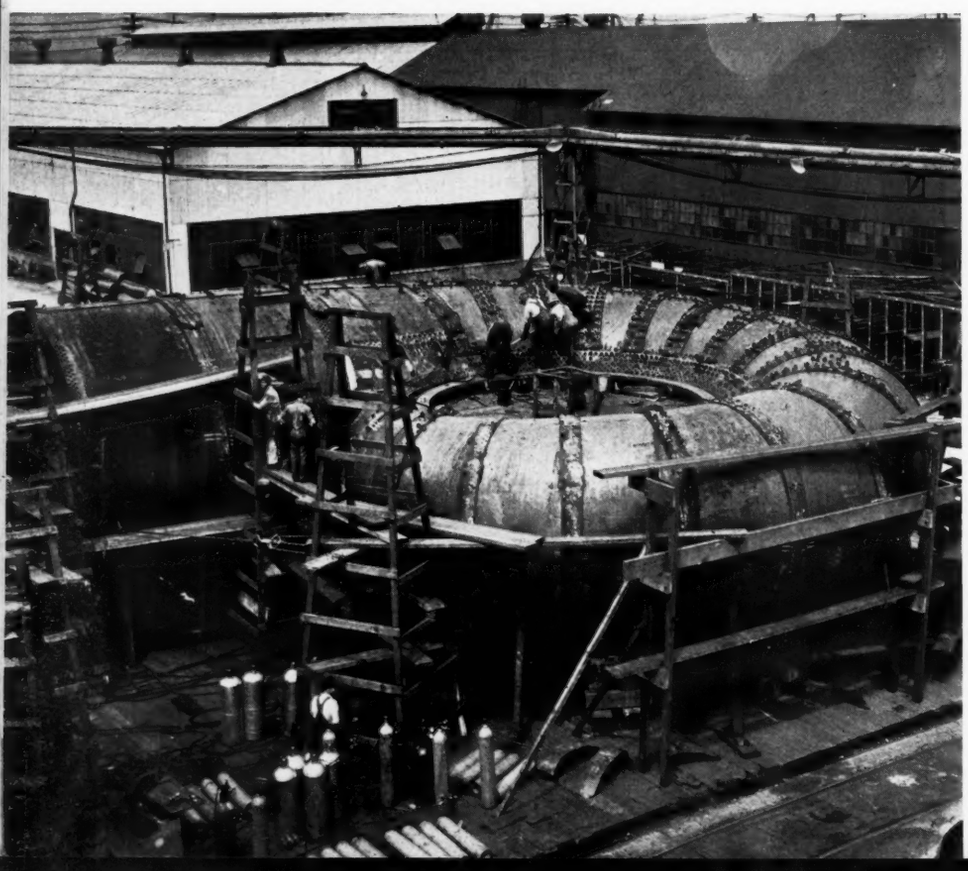


Plate-steel scroll case has intake 18 ft in diameter

SCHEDULED for first operation in August, the Hiwassee hydro project of the Tennessee Valley Authority is designed for two 80,000-hp units, one of which is now being installed. This development, on the Hiwassee River, a tributary of the Tennessee in North Carolina, includes a 1265-ft-long concrete gravity dam with a maximum height of 308 ft, forming a reservoir of 362,000 acre-ft effective capacity.

Photos show the runner and scroll case for the turbine being built by the Newport News Shipbuilding & Drydock Co. The runner weighs 95,000 lb and will develop 80,000 hp under 190-ft head at 120 rpm. The plate-steel scroll case has an intake of 18-ft diameter and with its speed-ring assembly required the driving of over 18,000 1¼-in. field rivets.

THE OPERATING ENGINEER

George Edwards
Advisory Editor

Practical Aids
Maintenance Hints
Questions — Answers

Published monthly as an integral part of POWER

DIESEL-POWERED FLOUR MILL

Learns from Experience

The lesson—"Get the right diesel for the job". After high-speed marine engine proved an expensive flop, 300-rpm one-lunger turns out a barrel of flour for 8 cents, which includes all power operating and fixed charges

THE PLANT of Sperry Gerard Milling Co, on the outskirts of Rochester, N. Y., has changed little in outward appearance since it was first started over a century ago. Yet it keeps going and making money, in good times and bad, and is today generating its power, at a gross cost per barrel of flour considerably less than the national average of the big flour mills. Eight cents per barrel is the Sperry Gerard figure; this includes supplies, maintenance, repairs, interest, depreciation, insurance.

Any man who has assumed that low cost requires mass-production methods will find it worth his while to talk with the two men who constitute management, office force, sales staff, purchasing agentry and plant foremanship—David C Naramore (owner and top boss) and S C McKown, Jr (his assist-

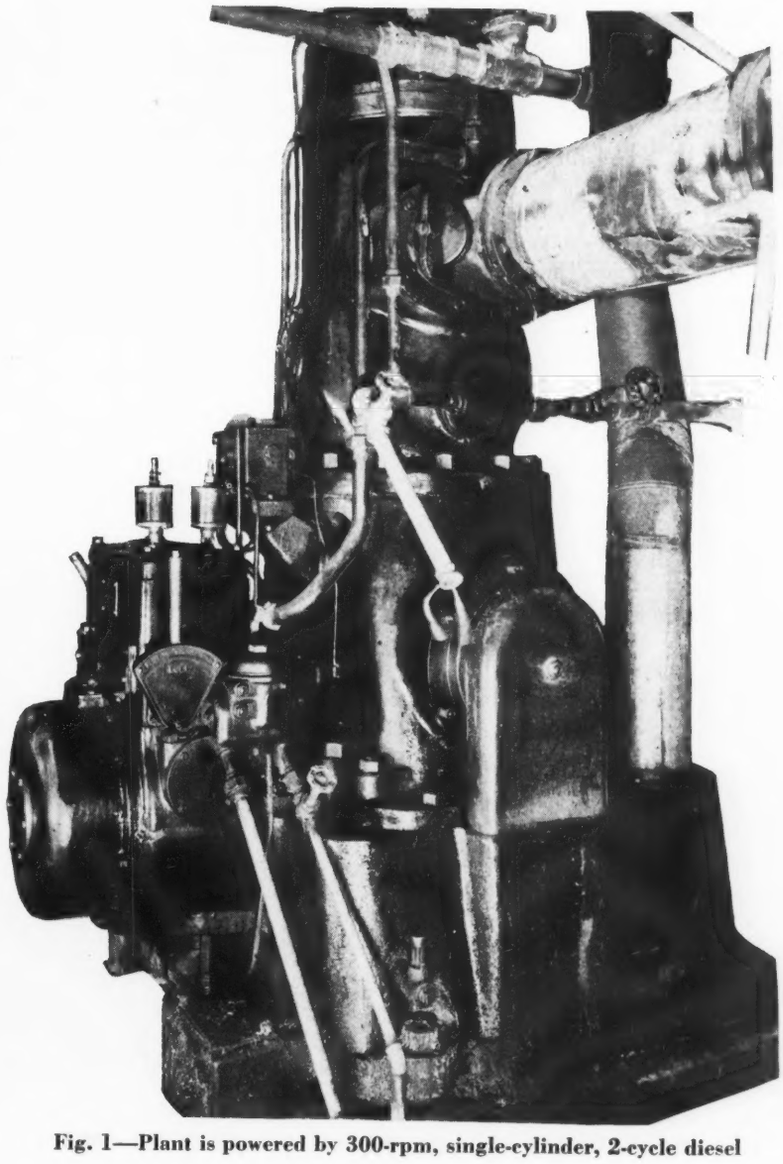


Fig. 1—Plant is powered by 300-rpm, single-cylinder, 2-cycle diesel

ant). Standard uniform for this executive branch, two hard-working graduates of Williams College, is a pair of overalls.

Sperry Gerard Milling Co has a rated capacity of 75 barrels per day—all pastry flour. Farmers drive up with their locally grown wheat, wait for it to be screened, get paid for the net bushels delivered, and cart the screenings back to feed the chickens. The entire mill output is sold in Rochester or within trucking distance.

This mill is now, as it has been for over 100 years, a strictly local business as to both raw materials and market. That, says Messrs Naramore and McKown, is the reason it kept going when big mills on railroads all over the country were shutting down because they couldn't make their costs. Sperry Gerard is on a creek; has no railroad connection.

A small mill of this sort can show a favorable production cost per barrel, has no transportation cost either on wheat or flour, no salesmen, no commissions, no middlemen, and keeps going nicely when more ambitious outfits hit the doldrums.

The Irondequoit Creek powered the mill until 1934. Latest water wheels, installed in 1912, are still in place, but the wooden teeth of their vertical-shaft bevel gears are now pulled out of contact with the line-shaft pinions, and the old shaft spins by diesel power.

In all, the main shaft is 40 ft long, belted to the diesel at the center, to an old 60-kw ac generator at one end and to the mill shafting at the other. Rather a roundabout arrangement, but it works. At some time later a few hundred dollars worth of millwrighting will consolidate equipment and make a better looking job. Meanwhile, power is cheap, which is the main point.

The managers are completely frank about diesels, know the worst and best about them. The bad experience came first. In 1934 they disconnected the water wheels and started to buy power. Costs were too high, so they turned to diesel power a year later. As they see it now, they made a big mistake in installing a high-speed, multi-cylinder marine job. "It might have been alright on a boat," they say, "but it was nothing but a headache driving the 24-hr-a-day steady full load of a flour mill that was supposed to run months at a stretch without stopping."

Costly Experience

The 60-hp, 6-cylinder, 1200-rpm machine simply couldn't handle the job. In a year and a half it ran up a maintenance cost 50% greater than the total cost of the engine. It was down every weekend for a whole Sunday's job of scraping hardened sludge from lube-oil filter, crankshaft, crankcase and injectors.

Injectors were always sticking. In desperation, Mr Naramore tried a solvent—5 gal per 1000 gal of fuel oil. It cost a dollar per gallon, but that didn't matter if it would cure the trouble. It didn't cure it, but helped; the sludge was much softer. Injectors didn't stick so often. Nevertheless, the engine was on the way out and had to go. Parts were failing left and right.

In 1937 the marine engine was thrown out and replaced by a big, slow-speed one-lunger—a 300-rpm, 1-cylinder, single-acting, 2-cycle Fairbanks Morse. Bore is 14 in. and stroke 17. With the flour-milling type of load, and the big flywheel effect of line shafting, the speed fluctuations of the 1-cylinder outfit were of no consequence. All that counted was economy and reliability—reliability first. So far, the new machine has been entirely satisfactory in both respects, and the managers are fully sold on diesels, if you get the right diesel for the job.

The plant burns No. 2 fuel oil, bought at prices that have ranged between 4.65 and 6.25 cents per gal. Mr Naramore pays around 77 cents per gal for lube oil (treated SAE 20). Past experience has made him leery of low-priced oils.

Maintenance is now largely a matter of routine. Heads are removed and pistons pulled for inspection and cleaning about once a year, although plans call for a 6-month period. When the new engine started operating, Mr Naramore tried omitting the solvent, but got some sticking of injectors, so began using it again. His present practice is to keep a spare injector on hand and replace it every six months, sending the old one back to the factory for a moderate-priced conditioning.

Jacket water is cooled in a small roof tower with an average daily water loss of about 50 gal. After three years, the jacket has been chemically descaled once, to remove a $\frac{1}{16}$-in. deposit. From now on, they plan to add a teaspoonful of soda ash per day to the cooling-water circuit, which they hope will eliminate even this slight scaling.

Because most of the engine power goes directly to line shafting, there is no precise measure of power generation or of fuel and lube-oil consumption per hphr. The flour mill gives a steady 24-hr load for 5½ days per week. The engine generates about 55 hp, and consumes about 2½ gal of fuel per hr. Lube oil is around 4 gal per week.

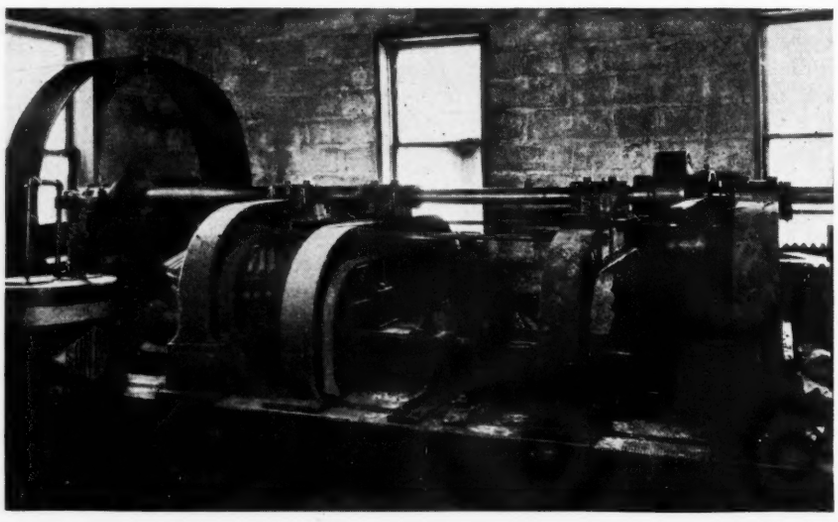


Fig. 2—Line shaft, once geared to water wheels, now powered by diesel, is belted to generator at left end, drives mill shafting from other end

DON'T USE COMPRESSED AIR
to Empty Barrels or Drums

By GEORGE EDWARDS

TWO READERS, Lawrence M Larson of Milwaukee, and A G Sutcliffe of the Engineering Dept, ILG Electric Ventilating Co, have called our editors on the item on page 93, January POWER, describing a way of emptying oil drums with compressed air. I'm very glad they did, because so few men realize the terrible power of air at normal line pressures. Let the oil plug at the outlet clog or congeal due to cold, and that air line on a 55-gal drum (22 in. in diameter x 34½ in. high) can build up a pressure of 11x11x3.14x110, or almost 42,000 lb! That'll blow any drumhead off like a shell from a gun.

Mr Larson tells of a happening under exactly these conditions, when an oil drum on its side was drained with air pressure. The oil was cold and the oiler opened the air valve a little too far. The flying head hit another employee above the knees. Both legs had to be amputated. Mr Sutcliffe tells of a similar setup for emptying a much heavier-gage tank of paint. The paint was thick and the tank blew up—the only thing that saved the operator being the fact that he wasn't nearby.

Mr Larson also talks of horseplay with an airhose—in one case describing the loss of an eye because a piece of hose flew from the end of a hose pointed at a fellow employee.

It so happens that I had already seen the item and called the attention of the editors to it, because of a number of my own experiences with the hazards of thoughtless or ignorant use of compressed air. In fact, I had some of my own experiences in mind when I wrote my page on "Half Right" last month. Here are four other examples:

In one case, a painter poked at a clogged paint-spray gun with a wire, with the gun pointed toward himself. He still has the clogging dirt and some paint particles under the skin of his face. In another, we were cleaning a large oil blow torch and found the fuel oil had sludged in the nozzle. I planned to clean it with pressure, so my helper attached the hose. When I said "O.K.", he opened the valve, and a solid slug of oil flew across the shop and hit the superintendent, who was paying us a surprise visit completely dressed in white sport clothes. He wasn't hurt, but his white flannels, silk shirt and Panama were permanent losses from that acid sludge.

Wrecked Riveter

In a third case, an inexperienced riveter tripped the trigger of his hammer without the die on the rivet. Die and piston flew from the gun and struck his helper's chest, fortunately at a slow enough speed that the helper was only bruised. But that riveter went to the hospital with his jaw broken in two places—his helper promptly clipped him with a bucking bar.

The final incident was more serious. In horseplay, one employee of an oil refinery "goosed" another with an air hose blowing free. His victim died in agony with his intestines literally blown to smithereens.

So by all means be just as careful in the use of compressed air as you are in the use of gas, high-pressure steam, or electricity. It has just as many potentialities for tragedy if it is ignorantly or carelessly used. In the particular case we are talking about, I am inclined to think that "the old way is best". Take the little extra time required to put the drum or barrel up on a tilted support and let gravity be your assistant. If you must have pressure, you can apply it with a hand pump.

ONCE IS TOO OFTEN
To Dry-Fire a Boiler

By C C CUSTER

Don't wait to learn from your own experience—you may not survive it. These cases from a boiler inspector's notebook show common causes for dry-firing accidents

INSURANCE RECORDS, the scorecards of operating vigilance, show that dry-firing accidents happen a lot oftener than the general public or most operators realize. Whether or not mechanical defects play a part, the operator in charge must shoulder some of the blame for the boiler attendant's ignorance or negligence forms the real cause of most such accidents. Typical cases, from my notebook, show how the same mistakes, made over and over again by different operators, lead to the always unsuccessful stunt of trying to run a boiler without water. Learning from the experience of the poor guys who tried the stunt is a lot easier than learning from your own experience, and a lot healthier. Avoiding the common mistakes described here won't guarantee you against trouble but they sure will help.

The hero of our first case had been a fireman in the Navy. He knew his

He was used to working with a water tender

stuff, but was used to having a watertender working with him. Although he was introduced to the boiler-feed pump on the first night, he forgot about it on the second and got low water. The fusible plug in the rear head of the hot boiler blew and the net result was that two top rows of flues in the rear head were loosened and had to be expanded.

Now we shift the scene to a locomotive roundhouse. The master mechanic and some of his gang stand in front of "old 999," just cleaning up after overhauling the baby. It's quitting time and the master mechanic greets the night "hostler"—"Well, there she is, ready to be fired up." The hostler takes his words for what they're worth, and builds a fire in the boiler without noticing that there isn't any water inside. By the time he finds out, the boiler is ready for another overhaul. The master mechanic, of course, just meant that the repair job was finished, but that wasn't the idea he gave the hostler. That poor guy lost his job, while the master mechanic got a good bawling out. The point to remember is that you can't depend on others. When you're responsible for something, check up for your own protection.

Two Simple Rules

Dry-firing cracks many a cast-iron sectional heating boiler every winter. Many times this happens because, in an ordinary gravity system, the boiler needs water so seldom that the attendant gets out of the habit of watching the glass. Following two simple rules would eliminate a lot of these troubles; (1) always blow down the water column when coming on duty, and (2) always glance at the column before throwing a fire.

A large cast-iron-sectional boiler heated a YMCA building. To get the swimming pool up to temperature the boiler attendant would sometimes blow a little steam into the pool and replace the loss by running some water into the boiler. One day some of the smarter boys found the water a little cold and fixed it up without looking for the attendant.

On his return, he noted that his steam was down but missed seeing that the water was low. He put in a heavy fire and in a short time came back to find a couple of sections cracked. If there is any excuse for a steam connection of this kind on a heating system, it should be locked shut so only authorized persons can operate it.

Always glance at the column before throwing a fire

The operator at a school building came in one morning and found that one boiler needed water while the other did not. He filled the one, then fired both and went about other work. In about an hour he came back to the boiler room—just in time to see the fusible plug on the second boiler let go. The first-pass tubes were ruined and had to be replaced. We found that the gage glass had a dirty ring around it which, to a quick glance, looked like water level. It had fooled him into thinking he had a half-glass of water when he didn't have any to speak of. A good operator won't stand for a dirty glass—he's smart enough to clean or change it.

A frequent cause of trouble is the fireman who fails to close the blowoff valve tight and so lets the boiler water leak out slowly. I remember one case where a night watchman was told to fire up a boiler that had just been cleaned, and to have it ready for service in the morning. He filled the boiler to half a glass and started a slow fire. At about 2:00 AM the fire had gotten considerable headway and he found he had about 15 lb of steam, but no water! He ran to start the pump, which was the wrong thing to do, and then came back and opened the fire door to be greeted by a bursting first-pass tube. He was blown back on the coal pile, much scared but little hurt. The boiler didn't get off so easily,

however, as it had to be practically completely retubed. A check-up showed a chunk of scale under the blowoff valve disk.

This wouldn't have happened if the blowoff line had been built to Code requirements, with two blowoff valves, one being a standard plug marked to show whether or not the valve is closed. Many blowoff lines are piped to the sewer, so that the engineer has no way to see if the valves are leaking.

Many other cases might be mentioned showing common mechanical troubles leading to low water such as: feed-pump trouble, constricted boiler-feed lines, check-valve trouble, automatic-feed-device troubles, and water-column defects. The experienced engineer or fireman will generally spot these conditions before water gets dangerously low and if the trouble can't be cured right away he at least has a chance to pull the fire and shut down the boiler before damage occurs.

Feed pumps sometimes fail to operate after being packed too tight with

Greeted by a bursting first-pass tube

fresh packing and sometimes because packing is worn or valves don't work properly. Having two boiler feed pumps guards against danger on this score. In most cases, an outside packed plunger pump makes a most dependable feeder, and almost any kind of a pump works more dependably than an injector.

Check valves sometimes cause trouble if the working parts are too tight, causing the valve to stick. Feed lines may become partly clogged with scale where they enter the boiler. Duplicate feed lines into the boiler will help insure reliability. Water column connections that are partially stopped may lead to the engineer's undoing if he doesn't find out in time. If either top or bottom connection is stopped, water in the glass may stand higher than that in the boiler. A good engineer won't depend entirely on water columns with automatic alarms, as they some times fail because the floats get water logged, the float gets hung up in the column, or the whistle outlet gets clogged with mud.

✦ ✦ ✦

Practical Answer to a Feedwater Problem

I HAVE READ "What is pH?" in your November issue, and would like further information. How much soda ash would be needed in water with the following analysis to give a satisfactory pH after treatment with soda ash?

pH value	8.23
	Ppm
Bicarbonate alkalinity	145.0
Total hardness (as $CaCO_3$)	192.0
Iron, Fe	10.1
Magnesium, Mg	15.6
Calcium, Ca	51.3
Sodium, Na	1.6
Sulphate, SO_4	47.8
Bicarbonate, HCO_3	177.0
Chloride, Cl	0–0
Fluoride, F	0–2

Using the method shown by W J Ryan on page 278 of POWER, May, 1936, I calculate that 10.5 lb of soda ash will be required for each 25,000 gal of water.

With regard to the pH value, which in this case is stated to be 8.23 before soda ash is added, how much soda ash should be added to give a suitable pH value, which I gather would be between 10 and 14—K M HILLIS–HARRIS, *Calgary, Alberta.*

[*Editor's Note: The following answer was prepared by W J Ryan, Water Service Laboratories, Inc, New York, N. Y., a frequent contributor to* POWER.]

In replying to Mr Hillis-Harris's question, I assume that it relates to treating this water for boiler feed.

The non-carbonate hardness is 192.0 — 145.0 = 47 ppm, expressed as $CaCO_3$. The amount of soda ash theoretically required to react with this non carbonate hardness can be figured from the following formula (simplified form of that given in Power, May, 1936):

Pounds of soda ash per 1000 gal of water = Total hardness — alkalinity ÷ 113. Inserting data from the analysis submitted by Mr Hillis-Harris, we get:

Pounds of soda ash per 1000 gal of water = 192 — 145 ÷ 113 = 0.42 lb per 1000 gal. Soda ash per 25,000 gal would be 0.42 × 25 = 10.50 lb. These check with the computation made by Mr Hillis-Harris.

Mr Hillis-Harris asks: "How much soda ash should be added to give a suitable pH value, which I gather would be between 10 and 14?". The pH of boiler water should be about 10.8 to 11.2, and this can be maintained by adding a little excess of soda ash, over the amount theoretically called for, sufficient to maintain a total alkalinity in the boiler water of about 100 to 200 parts per million (expressed as $CaCO_3$). A pH of 14 would be out of the question in a boiler, as it could only be reached in a very strong alkaline solution.

It would seem that if "internal" treatment is to be used with this water, consideration should be given to the sodium phosphates. The water has a high content of calcium bicarbonate, and, if soda ash is used, this, as well as the sulphate hardness, will be precipitated as calcium carbonate which may cause a troublesome deposit. Better yet, the water can be given external treatment in a hot-process lime-and-soda-ash softener to actually eliminate most of the hardness before water enters the boilers. The high content of carbonate hardness in this water points to the suitability of a hot-process softener, rather than a zeolite softener.

Mr Hillis-Harris refers to G A Perley's article in November, POWER, and asks how the pH values in Table I were arrived at.

Let us consider the first item in the table, a normal solution of hydrochloric acid (HCl). As stated in the article, a chemically normal solution has a concentration of one gram equivalent per liter. Therefore, a normal solution of HCl, if it were completely ionized or dissociated, would contain 1 gram equivalent of Cl (chlorine) and 1 gram equivalent of H (Hydrogen). The hydrogen-ion concentration, which is expressed in terms of gram equivalents per liter, would be 1. It is known by experience that the acid does not completely ionize, but in a solution of this strength it is about 80% ionized and, therefore, the H ion concentration is 0.8 rather than 1.

Now, the pH value of the solution is the logarithm of the reciprocal of the hydrogen-ion concentration. The hydrogen-ion concentration is 0.8, the reciprocal of 0.8 is 1.25, and the logarithm of 1.25 is 0.0969, or approximately 0.10. Therefore pH value is 0.10.

PRACTICAL AIDS TO OPERATION

Simple Way to Pack Valve-Bonnet Joints

BONNETS on globe and check valves are threaded into the valve body to make a pressure-tight metal to metal contact that is frequently not easy to open. In our plant, whenever we open one of the valves to renew or repair its disk or seat, we always make the bonnet joint up with packing.

We take one or two strands from a graphite-lubricated cord packing and interlace them to form a ring that will fit tightly down around the bonnet threads, as in the photo. When the bonnet is screwed into place, the packing makes a pressure-tight joint without metal to metal contact except in the threads. Then, when the joint has to be opened again for repair or inspection, it is easily done.

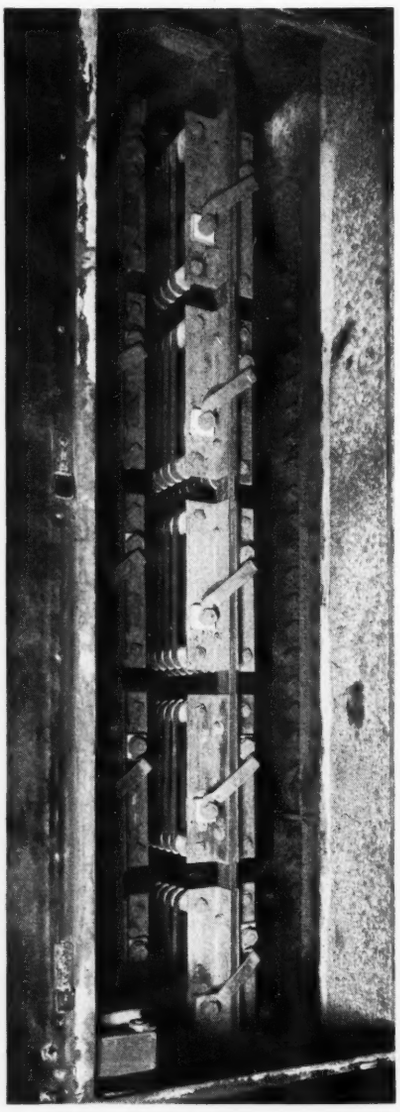
Riverdale, N. Y ALEX GRAY
Chief Engr, Colored Orphan Asylum

Electric Heaters Reduce Office-Heating Costs

DURING the cold, damp days of late autumn and early spring, the offices of the National Malleable and Steel Castings Co, Cleveland, Ohio, are heated by electric units. On unusually bitter-cold winter days, the electric-heating installation is also thrown on to supplement the steam-heating plant. Thus electricity gives the company a heating system which is flexible enough to provide working temperatures during all kinds of weather and at the same time cuts the heating bill.

Two steam boilers used for heating the offices from Oct. 15th to May 1st, cost approximately $35.00 a day to operate. Electric equipment, which is used at other times when heat is required, costs approximately $15.00 a day to operate.

The offices are heated through a system of ducts and washed air, by a fan with a capacity of 55,000 cu ft per min. Five General Electric electric heating units were installed within the washed air ducts, as in the photo, so that the air which comes from the ventilators is, in season, heated electrically. Each heating unit is rated 50 kw on 440 volts, which gives the building a possible temperature rise of 17 F. When thermometers on each floor show that this temperature has been reached, it ordinarily is possible to cut out three units. The other two are then sufficient to hold the temperature through the working day when the steam boiler



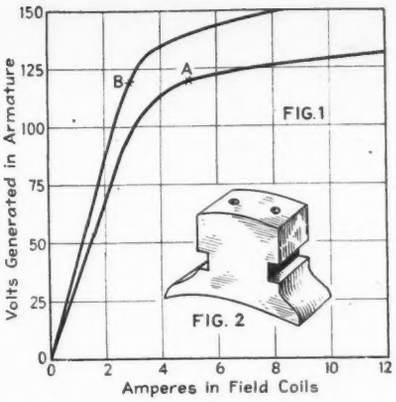
is not in operation. On damp days when the humidity in the offices becomes higher than is comfortable to work in, the heaters are turned on for a sufficient time to condition the air.

To heat up the cold air rapidly within the ducts each morning before office employees arrive, all five heating units are turned on for about 10 min. before the fan is started. To do this preheating, the safety cut-out is short-circuited by a pushbutton held closed manually by an operator for the entire 10 min.

Cleveland, Ohio K A GOTTSCHALK
Cleveland Electric Illuminating Co

Notched Polepieces Parallel Generators

SOMETIMES it is difficult to get two direct-current generators to operate in parallel, particularly if no attention was given to the voltage curves of the machines when they were purchased. When you have this trouble, obtain a voltage curve of each machine by plotting field amperes against volts generated. One machine may generate rated volts when excited above the knee of



the curve, as at *A*, Fig. 1, and the other excited below, as at *B*. When this happens satisfactory load division between the machines cannot be obtained until voltage of machine *B* is brought more in line with that of *A*.

On one job of this kind, after consulting the designer of the machine, we cut a slot ¾ in. deep by 1¼ in. high in the side of each polepiece, Fig. 2. This change reduced the voltage of the generator for a given field current and made it possible to operate the machine in parallel with another. If steel shims are between polepieces and frame, removing them may be sufficient to correct the voltage. When a 110-volt machine is operated at, say 50 volts, it is very likely to be unstable under load, unless some change is made in its magnetic circuit, such as suggested here.

Plainfield, N. J. H W HODGSON

Watch Wear in Motor Bearings

INDUCTION MOTORS operate with very close clearance in the air gap between rotor and stator. Because of this, small wear in the bearings may seriously affect operation of these motors. A case in mind is that of a split-phase-type single-phase motor that burned out its starting winding. I replaced this winding, checked the bearings and found only a small amount of wear. When the motor was assembled and connected to the line it would not accelerate to a speed sufficient to open the centrifugal switch. Thus, I couldn't cut out the starting winding.

This explained why the starting winding burned out, but what prevented the motor coming up to full speed was the problem. After worrying over this for some time, I decided to try new bearings in the motor. These

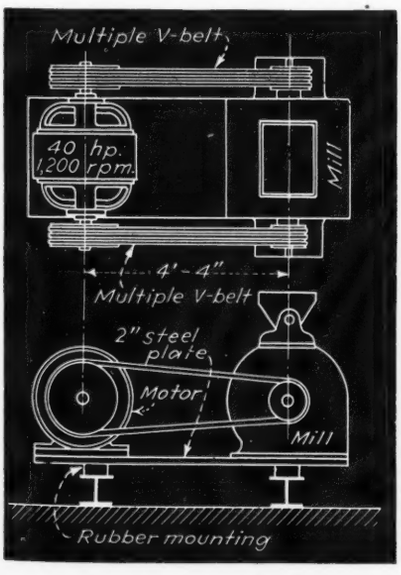
(Continued on following page)

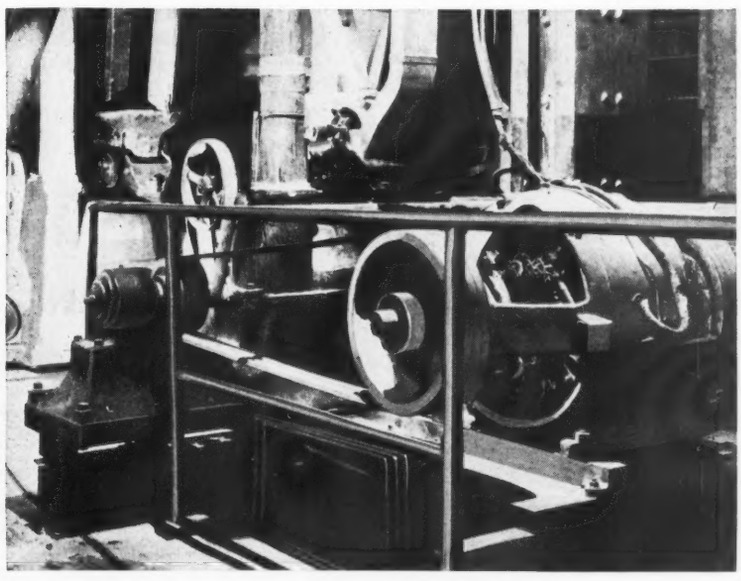
Steel-Slab Foundation Cures Drive Trouble

SOME OF OUR SUGAR MILLS are tandem driven by multiple V-belts from each end of a 40-hp motor. To improve operation, we mounted each mill and its motor on 2-in. steel bedplates, as in the drawing and photo. We placed the plates on rubber vibration absorbers and now the machines operate nearly noiselessly. There is no apparent slipping of the belts as there was before mounting the equipment on the bedplates.

The new arrangement acts very much like a direct drive and the rubber mountings prevent vibration from being transmitted to the building. The steel bedplates were cut at the mill to our drawings and cost less than they would if we had cut them out of rectangular plates and sold the excess metal for scrap.

Philadelphia, Pa.
WALTER KROTEE
Pennsylvania Sugar Co





corrected the trouble. Since then, I have found slightly worn bearings on several other induction motors that caused faulty operation.

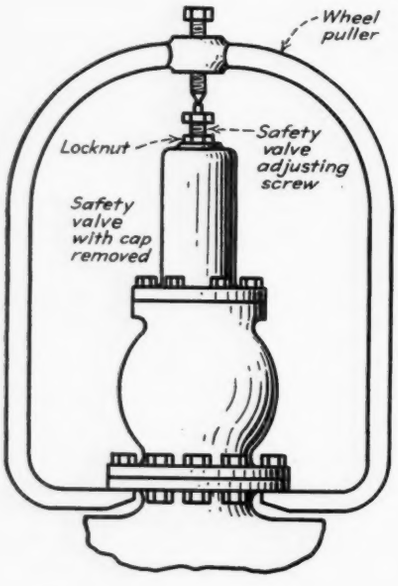
Philadelphia, Pa. R O SPENCER

Red Lights Signal Motor Trouble

IN OUR PLANT we have a system of exhausters that takes refuse material from different departments and discharges it into a large duct from where a large fan delivers it to the boiler room. If the large fan stops unnoticed, the other exhausters continue to run and plug the system with refuse. This happened twice and each time required considerable work to get the system going again.

The motors operate on 440-volt power, so I connected four 115-volt red lamps in series across the terminals of the motor driving the large fan. If we see these lamps go dark, we shut down the small exhausters immediately until the large fan can be put into operation again.

Philadelphia, Pa. R O SPENCER

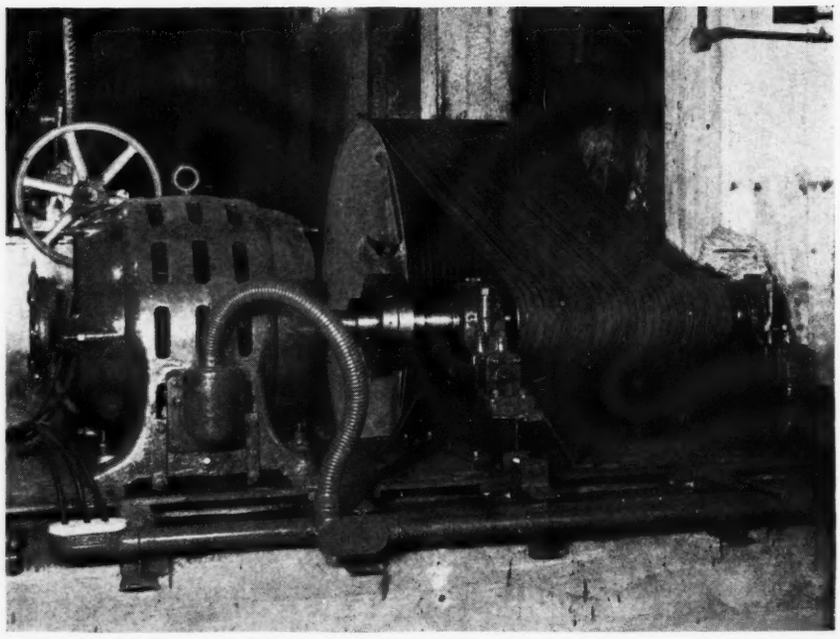


Truck-Wheel Puller Gags Safety Valve

RECENTLY it was necessary to make a hydrostatic test on one of our boilers before putting it back into operation. We had to return the boiler to service as soon as possible and did not want to take the time to remove the safety valve and close its connection with a blank flange. A gag to hold the valve closed was not available, so we solved the problem with a truck-wheel puller applied as in the figure on the left.

To do the job, we removed the locking cap and lifting gear as you do in applying a gag. Then, we had only to tighten the puller onto the valve sufficiently to make sure that it would stay tightly closed. This little trick permitted making the boiler test without interfering with the safety-valve adjustment.

Cleveland, Ohio A C WIGGINS



How We Licked a Heavy-Drive Problem

WE HAD TROUBLE with a drive on a paper-beater driven by a 150-hp wound-rotor motor. The drive overhung on the motor bearing, overloaded the bearing and made frequent renewals necessary. A multiple-V-belt was installed, but it did not cure the trouble.

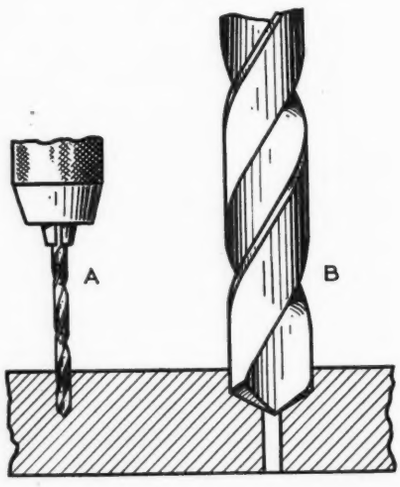
We made a new shaft for the motor, long enough for the 26-V-belt sheave and an outboard bearing, mounted on a separate base. After a week's operation, the drive started to vibrate and chatter. An inspection revealed nothing wrong but three more day's operation broke the shaft at the motor bearing. A new shaft was made and installed, but failed in 7 days.

Our engineering department then designed a complete base, of ¾-in. steel plate, for the motor and two bearing pedestals on each side of the V-belt sheave. We replaced the original shaft in the motor, mounted the sheave on a stub shaft and connected the two with a flexible coupling, as in the photo. The whole drive can now be moved on its base as a unit to maintain proper tension in the belts.

Rockford, Ill. NELS W OMAN

Pilot Hole Makes Drilling Easier

WHEN A PORTABLE drill is used for holes larger than ¼ in. in metal, considerable pressure must be used on the drill. I have found that the job can be made easier by first drilling a pilot hole *A* for the large drill *B*, see diagram. If a small drill is not available,



a long-pointed prick punch may be used, but the punch must be used frequently as drilling of the hole progresses.

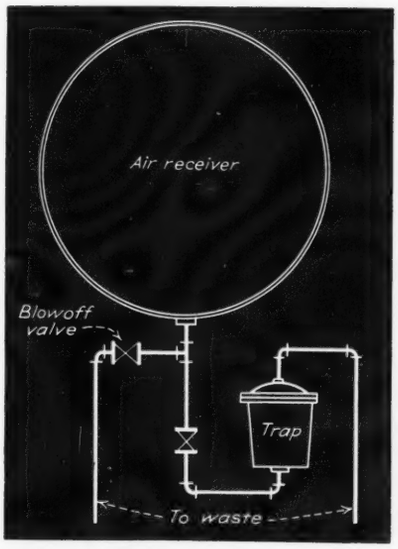
Penacook, N. H. C H WILEY

Traps Drain Air Receivers

OUR SINGLE-STAGE AIR COMPRESSORS in the power-plant basement discharge to air receivers outside the building. There are no aftercoolers and much of the moisture and oil carried by the compressed-air condenses in the receivers and must be drained off at intervals. This was formerly done by opening hand-operated drain valves on the receivers each 8-hour shift, but was frequently overlooked by plant personnel.

Rather than take chances with complications that might arise from this neglect we installed bucket-type traps in the receiver drain lines to remove the water and oil, see drawing. These traps have proved satisfactory in this service. They require very little attention other than scheduled observation, but they also reduce loss of air to a small part of that lost when the receivers were drained manually.

Roanoke, Va. S H COLEMAN



Simple Way to Take Down Steel Stack

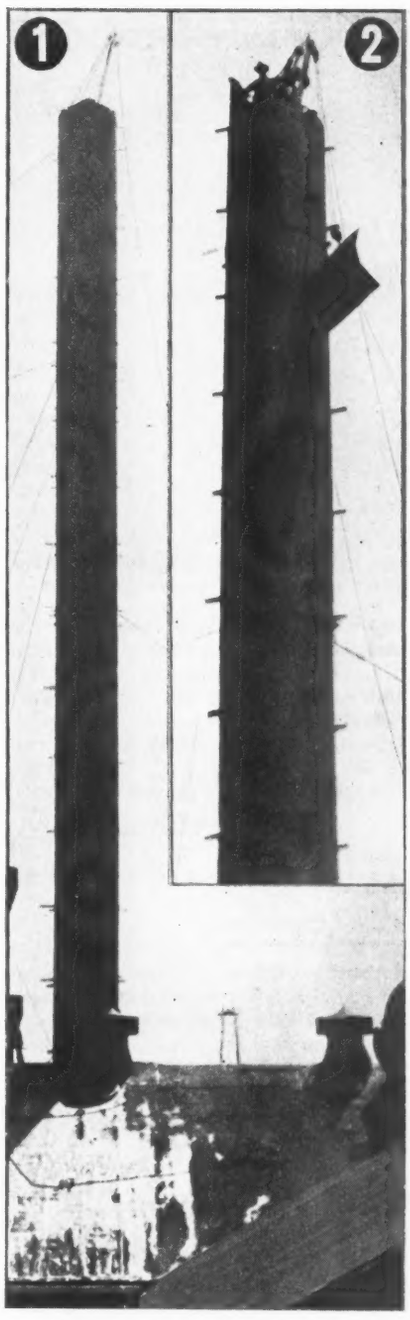
TAKING DOWN a steel smoke stack usually requires an inside or an outside scaffold from where workmen can break the rivets or use an acetylene cutting torch. Cost of such a scaffold is considerable in both material and labor. The photos show a simplified method in use that eliminates to a large degree the expense of a scaffold.

Starting at the bottom of the stack, the first step is to cut holes in it for cross members, which may be waste pieces of pipe, angle-or channel-iron, or wood. Waste steel is preferable, because of the fire hazard attendant to acetylene torch cutting of the stack.

The first holes are cut about 5 ft from the base of the stack and after supporting a platform from these, holes are cut about 5 ft higher up for the next cross members and platform. This process is continued until the top of the stack is reached as in Fig. 1. Then a short gin pole is set at the top of the stack.

Attach a block tackle to the top of the pole for lowering sections of the stack to the ground. The tackle is attached to the top of the stack in a hole cut by the torch. Two vertical cuts are made, dividing the stack in half, down to near the platform. Then a cross cut is made to free the section, which is lowered as in Fig. 2. The gin pole is then adjusted to lower the next section when it is cut free. This process is continued down the stack.

Oklahoma City, Okla. C R WENZ

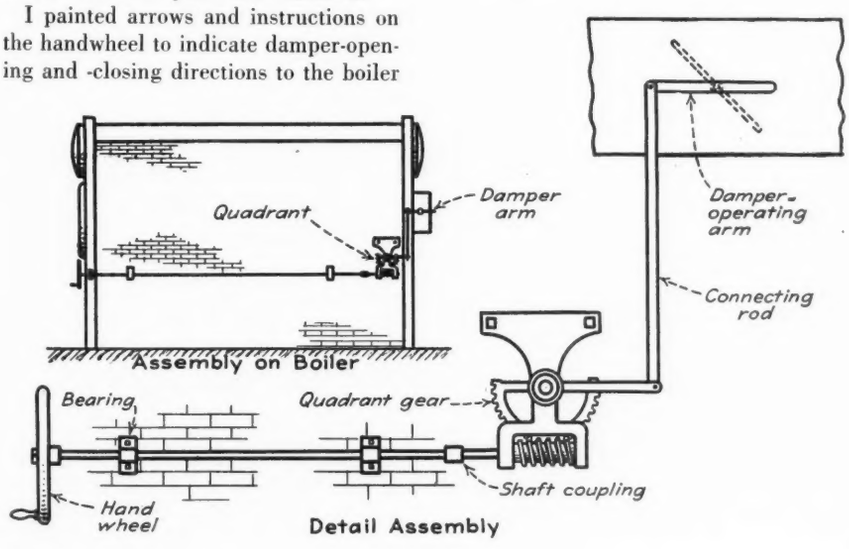


Window Operator Positions Damper

FACED WITH THE PROBLEM of operating a stack damper from the front of a boiler, I investigated equipment used to operate greenhouse windows. The diagram shows the results. This set-up may look somewhat expensive but it is low in cost because all parts are standard.

I painted arrows and instructions on the handwheel to indicate damper-opening and -closing directions to the boiler attendant. The equipment makes a neat job, is rigid and positive and permits close adjustment of the damper. Operators for positioning large metal-sash windows may also be used on dampers.

Bloomfield, N. J. J O G GIBBONS



READERS' PROBLEMS

Questions from Our Readers

Reducing Fan Speed

Question 1

AN INDUCED-DRAFT FAN *driven by a direct-connected, 50-hp, 1750-rpm slip-ring motor requires approximately 55 hp at 1750 rpm with open damper. However, the fan is never operated at this speed, but usually runs between 1100-1400 rpm. Rotor resistance is inserted to cut the speed. The arrangement is inefficient, and I would like to know if there is a practical and more economical way to operate this fan. Wouldn't reconnecting the stator for a higher voltage, and allowing a higher slip with resistance cut out, be better?*—NK

Installing Globe Valves

Question 2

I HAVE HEARD *that globe valves should be installed with pressure above the disk, and also that they should be installed with pressure below the disk. It looks to me as if the answer depends on the situation, that is, on whether you want the valve closed or open after the stem breaks or something else happens. I'd like to know whether other* POWER *readers agree with me on this, and if they do, whether they will give me some ideas as to locations where valves should be installed.*—MEF

SUITABLE ANSWERS from readers will be paid for if space is available for publication. Answers accompanied by practical drawings or photographs will command additional pay.

Blowdown Tank Connections

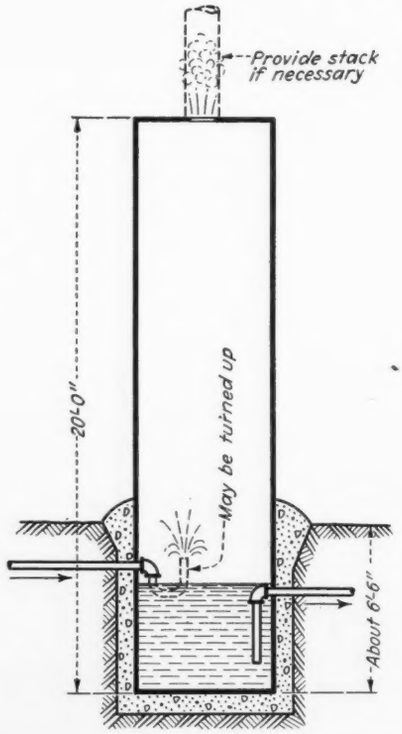
Answers to Jan Question 1

The Question

WE HAVE 8 hrt boilers, each 72-in. diam by 18 ft long. We want to install a blow-off tank in place of discharging the main blowoff line over the side of a steep bank. We have a steel tank, 5 ft diam by 20 ft long, that could be used for this purpose. Would it be large enough, and how should we hook it up?—GAK

Use Tank Vertically

A TANK 5 ft diam and 20 ft long is probably about 3 times as large as needed. However, this fact can be turned to advantage, as will be shown. The chief use of a blowoff tank is to get rid of steam caused by re-evaporation of the blowdown water at reduced pressure, and to lower the pressure and temperature of the water to approximately atmospheric conditions. Where drains are connected to public sewers, this is generally obligatory.



The large size of the tank suggests advisability of setting it vertically and using the upper part as a combined separating chamber and vent, as shown in the sketch. The tank sets in concrete, but this is not absolutely necessary, although it will strengthen the tank at the point of greatest stress. It also provides a water shed at the point where the tank enters the ground and is exposed to the greatest corrosion danger.

A hole, or series of holes, preferably having a combined area of not less than 1 sq ft, can be provided at the top of the tank, and if it is desired to discharge the steam at a higher altitude, a steel stack of comparatively light gage can be welded on. Water from the boiler can be discharged into the tank either above or below the water level, preferably above, but much will depend on the level of the sewer or other means of discharge. If the blow-off main is below the water level, it is a good idea to install a reversed check valve, leading from the atmosphere, or a vacuum breaker, near the boilers, so that high-speed slugs of water will not be drawn in, when the blowdown valve is closed.

With the high vertical tank, it might be advisable to turn the end of the blow-off main up, and shoot the water into the upper part of the tank, providing an efficient steam separator. If this is done, it will be necessary, perhaps, to install a fairly high stack on top of the tank to prevent water from being sprayed around.

Bloomfield, N. J. J O G GIBBONS

Cut Tank in Half

GAK'S TANK is much too big for the job and it would be poor economy to waste so much metal. I would cut the tank in half and weld on a new head, getting a blowdown tank 5 ft diam by 10 ft long, which is still plenty big enough. The remaining metal I would sell as scrap and the cash realized would probably pay for installation of the tank. Incidentally, if the tank has flat heads they should be stayed and braced properly, for although it is open to the atmosphere at two points, the blowoff tank is still a pressure vessel.

Brooklyn, N. Y. J P CAREY

Several Solutions

I ASSUME that GAK's boilers are designed for a pressure not in excess of 150 lb. If the steel tank has been designed for a working steam pressure of at least 150 lb, in conformity with ASME Boiler Construction Code, Section VIII, Unfired Pressure Vessels, paragraph U68, it may be used as a blowoff tank if properly piped in accordance with ASA Code.

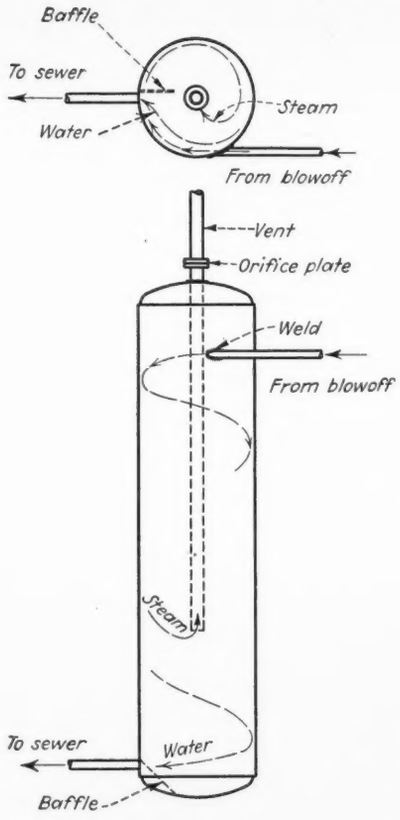
The tank should be provided with a suitable inlet connection, possibly 4 in. diam, and immediately below it there should be a baffle plate to prevent direct impingement on the shell wall. The overflow connection can be taken off at about horizontal center of one of the end heads. It should be 6 in. diam. The tank must have a 10-in. vent line for discharge of vapors considerably above the tank.

If the 5x20-ft tank does not conform with code requirements, a new blowoff tank may be procured, approximately 3 ft diam by 6 ft long, designed for 150-lb working pressure, and provided with the connections described above. If the 8 boilers are blown down one at a time, a blowoff device may be made of a piece of 12-in. extra-heavy pipe, about 10 ft long, with 4-in. inlet at one end, 6-in. outlet at the other, and vented vertically to atmosphere, through a 6-in. pipe, for disposal of flash steam. The 12-in. pipe should be set horizontally, anchored securely at the inlet end, and restrained by guides at outlet end to allow thermal but prevent lateral and vertical expansion.

Baltimore, Md. W S JOHNSTON

Set Tank Vertically

GAK's tank should be large enough for the purpose. The best way to hook it up would be to mount it vertically, with the



2 in. blowoff line entering it on a tangent about 2 ft from the top as shown in the sketch. This pipe should be cut on a long bevel and welded in. There should be a 6-in. vent pipe welded into the top head and extending to within about 6 ft from the bottom of the tank. There should be no valves in this line. A pipe flange should be placed a few inches above the tank head and an escape pipe run up about 3 or 4 ft. The drain to sewer should be at least 3 in. and a baffle made of ⅜-in. plate should be fitted and welded on the back side of this opening as shown in the sketch.

In operation, a large part of the water will flash into steam and the mixture will take a whirling motion, as indicated by the arrows. This will cause the water to separate and cling to the tank walls while the steam will work toward the center and escape out the vent. During the first trial, a pressure gage should be mounted near the top of the tank and the pressure noted. It should not be allowed to build up over 15 lb. If the pressure is too low, a large portion of the water will flash into steam. In such a case, an orifice plate made of ¼ or ⅜-in. steel should be placed between the flanges at the top of the tank to restrict flow of steam through the vent. The hole through this plate could be made about 4 in. diam to start with, and if the pressure tends to build up too high, it should be enlarged.

If not practical to mount the tank vertically, it will give fairly good results if mounted approximately horizontally, with a little incline to the outlet end. If there is no incline at all, too much water will collect in the bottom, interfering with the centrifugal action of the water and steam.

Pittsburgh, Calif. M L LINCOLN

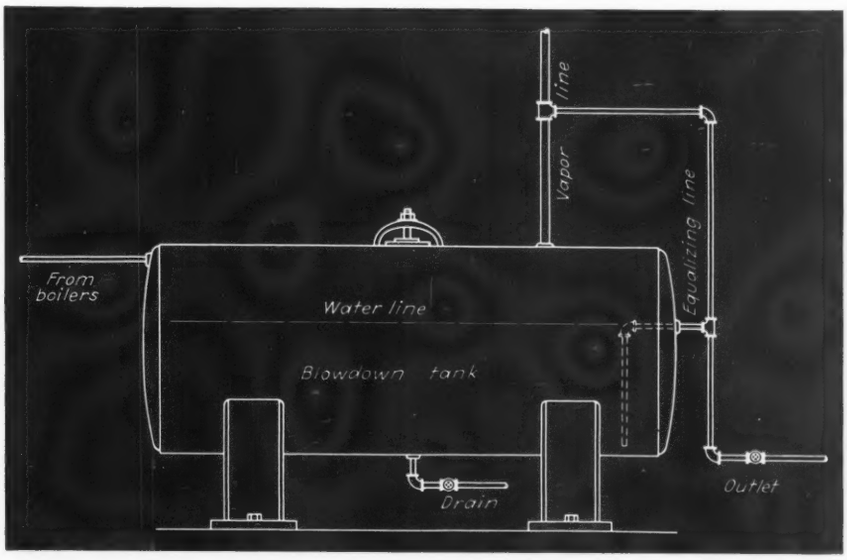
Use Outlet Valve

GAK'S TANK is unusually large for a blowdown tank but that is favorable, as the amount of water that can be blown from the boilers each time depends on the size of the tank. GAK's is big enough to accommodate the blowdown from several boilers before draining. Thus the tank should serve well, provided it is in good condition, properly connected, and suitably constructed to withstand pressure. It should be located so that it will drain by gravity to a sewer or other place of discharge.

The sketch shows a piping arrangement that has been found satisfactory for installations of this kind. Note that the outlet is fitted with an internal pipe dropping nearly to the tank bottom, to retain a large body of water in the tank, and prevent passage of steam through the outlet. Connection from the boilers enters above the water line which should be about ⅔ the tank height. When water from the boilers blows into the tank, cooler water from the bottom leaves through the outlet and steam passes off through the vapor connection at the top, this connection being piped to a safe point of atmospheric discharge, without valves. The vent should be as large as practicable, to prevent accumulation of flash-steam vapors which would increase blowdown-tank pressure during blowdown periods.

The equalizing line prevents any siphoning action from emptying the tank after movement of the water has once been started through the outlet. If the tank discharges to a sewer system, a valve should be placed at the outlet line to hold hot water in the tank until it cools sufficiently to be drained off without danger of damaging the sewer piping by expansion strains.

Jersey City, N. J. I S CHAMBERLAIN



How to Figure Tank Capacity

A BLOWOFF TANK does three jobs: (1) absorbs impact of water issuing from the boiler, (2) provides space for liberation of steam formed when pressure drops, and (3) stores water until temperature is lowered. No definite practice for taking care of these three functions has been established. The water capacity needed is usually taken as equal to or greater than a gage of the largest connected boiler. There is much difference of opinion as to the correct pressure for which the vessel should be designed to resist impact stresses. A safe rule is to make the tank design pressure equal to ½ the boiler pressure, and some insurance companies recommend a design pressure equal to the boiler pressure. In either case, the tank should conform to ASME Code for Unfired Pressure Vessels.

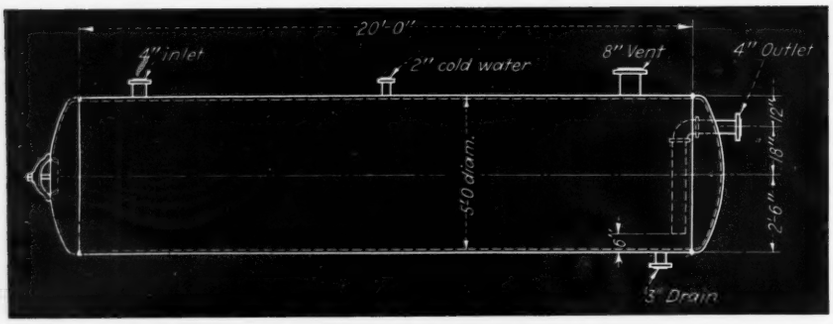
The steam-liberating space is usually about 15% over the water storage space. The great volume needed by the expanding steam is largely taken care of by venting the tank to the atmosphere, the area of the vent being about 4 times the inlet area. Ordinarily only one blowoff tank will be found in most boiler plants.

The discharge from blowing down a 72 in. x 18 ft boiler from the center to the lower gage cock will be about 30 cu ft. This is based on the assumption that it is 4 in. between gage cocks and that the average width of the boiler at the normal water line is 59 in.

$$\frac{144}{4 \times 59} \times 18 = 29.5 \text{ cu ft} = 221.5 \text{ gal.}$$

The volume of GAK's tank is 392.6 cu ft. or 13 times the water discharged from any one of the 8 boilers. Assuming the tank outlet is 18 in. above the horizontal center line, the water capacity of the tank would be approximately 336 cu ft or 2520 gal. This is equal to the blowdown of 11 boilers and is more than sufficient capacity for most operating conditions.

The tank should be installed above ground or in a space where it can be readily inspected by an insurance company representative. The vent pipe should run to a point at least 20 ft from the nearest accessible point, or through the roof. This pipe should run vertically, be properly drained, and should have as few turns as possible and no intermediate shutoff



valves. The outlet should have an internal pipe leading to within 6 in. of the bottom, to act as a syphon. This outlet is connected to the sewer, the water being syphoned over after cooling to normal temperatures. Some tanks are equipped with a connection for feeding cold water to the tank to hasten the cooling. All blowoff tanks should have a drain at the lowest point and 11 x 15 in. manhole for access and cleaning. The water should flow into the tank from the boilers by gravity. The sketch shows a typical horizontal blowoff tank that will fit GAK's setup.

Minneapolis, Minn. H K BANCROFT

Use Zeolite Softener

IN VIEW of the relatively low boiler pressure carried and the probable low solid content in the city-water supply, I suggest that the water used for makeup be passed through an inexpensive zeolite softener for most economically reducing to zero the scale-forming hardness salts of lime and magnesium. Some slight adjustment of the zeolite-softened water might be necessary to correct the sulphate-carbonate ratio and prevent silica scale, though this would depend on analysis of city water.

This arrangement gives a non-scale-forming water makeup of correct sulphate carbonate ratio, though if the raw-water analysis showed high alkalinity it would probably be advisable to post-treat with sulphuric acid to reduce the alkalinity and then degasify to remove major portion of CO_2 resulting from the acid treatment.

Clayton, N. J. S F ALLING

Bring Water to Zero Hardness

Answers to Jan Question 2

The Question

WE USE CITY WATER *that is treated with alum and lime; we treat the boiler feed with soda ash and trisodium phosphate. Steam pressure is 225 lb. Water from the boiler analyzes as follows: hardness 50 ppm; P alkalinity, 160 ppm; M alkalinity, 240 ppm. Should we use enough chemicals to bring water to zero hardness?* —COM

Reduce to Zero

FROM THE HIGH HARDNESS REPORTED, COM is evidently having trouble with scale. This much hardness used to be tolerated but economical modern boiler operation requires that hardness be reduced. Unless raw water is particularly hard, COM should be able to reduce the hardness to zero by feeding more phosphates. The alkalinity is too high also, so that he should reduce the soda ash treatment. An M alkalinity of 150 ppm would be better, as long as the pH value is kept up around 10-10.5. Since he must reduce both hardness and alkalinity, COM might try using disodium phosphate instead of trisodium, since that will serve his purpose better. Going a step further, and using sodium phosphate, may help keep phosphates in the water and will keep the concentration down. This treatment will help prevent scale and by reducing the concentration, may reduce carryover due to foaming.

Staten Island, N. Y. R A ATLAS

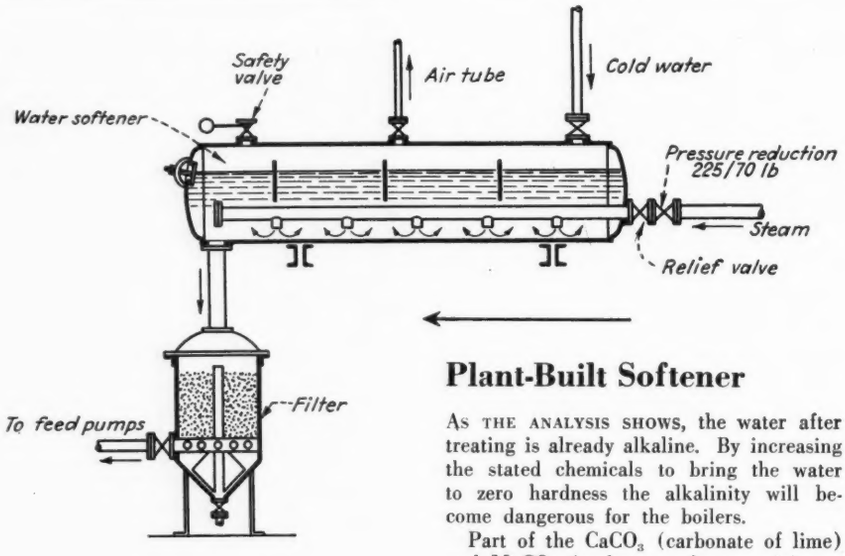
Check Sludge Condition

A SIMPLE ANSWER to COM's question would be "yes". Zero hardness is desirable, although by no means absolutely necessary, in all boiler waters. However, zero hardness alone does not insure clean evaporating surfaces. If it did, water treatment would be far simpler than it is. The condition of the sludge thrown down by the soda-ash and phosphate treatments is perhaps as important as the hardness. Unless sludge is properly conditioned and unless proper concentrations are maintained, a scale composed of calcium carbonate and calcium phosphate will be deposited even though zero hardness is held at all times.

It is quite possible that an increase in treatment at COM's plant will increase alkalinities to such an extent that trouble with carryover will be encountered. It is also possible that alkalinities will go so high that the sulphate-total alkalinity ratio will be upset. It is possible that treatment with soda ash and trisodium phosphate is not the right answer.

Generally speaking, if a raw water actually requires soda ash and phosphate treatment, a mixture of soda ash and disodium phosphate is more satisfactory than trisodium phosphate. On the basis of P_2O_5 content it is less expensive, less is required in lb, and the resulting boiler water alkalinities are not so high as when trisodium is used.

Chicago, Ill. H A GUSTIN



Plant-Built Softener

AS THE ANALYSIS SHOWS, the water after treating is already alkaline. By increasing the stated chemicals to bring the water to zero hardness the alkalinity will become dangerous for the boilers.

Part of the $CaCO_3$ (carbonate of lime) and $MgCO_3$ (carbonate of magnesia) can be separated with good success by boiling the feedwater with steam at about 70 lb, and filtering the water, see sketch.

Vancouver, B C ALEXANDER KAPLAN

George Edwards Sums Up

Question 1

GAK'S TANK has plenty of capacity—but he'd better be certain it conforms to the ASME Code for Unfired Pressure Vessels. I like M L Lincoln's set-up for a vertical tank best, but Mr Chamberlain's horizontal one is good too, although I'd tilt the tank a little towards the outlet end and place the drain there.

Question 2

MORE INFORMATION on this problem is given on pages 105 and 106 of this issue, which are part of the current series on feedwater analysis and treatment. Last month, we showed what belonged in a kit and how to use it. This month we talk about testing for hardness, in April it will be determination of alkalinity, and in May of chlorides. GEORGE EDWARDS.

Figuring Indicated Horsepower

By PHIL SWAIN

THE INDICATED horsepower (IHP) of a steam engine is the power developed *at the piston.*

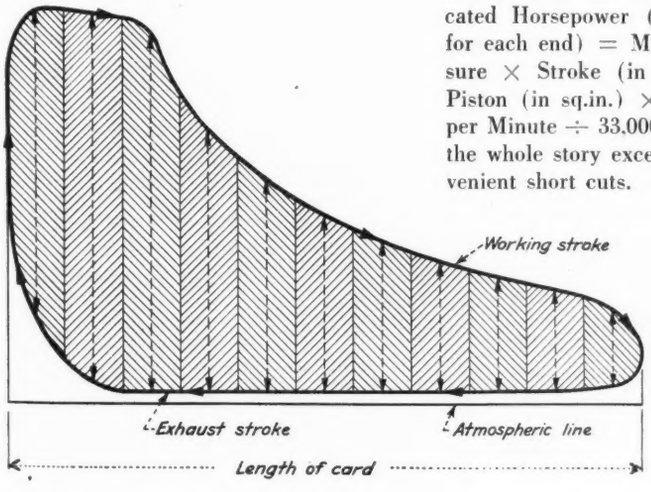
The brake horsepower (power delivered to the connected machine) is slightly smaller because of friction of moving parts. Very often it isn't convenient to measure the brake horsepower; hence the common use of *IHP*, figured from cylinder dimensions, speed and the mean effective pressure.

To find mean effective pressure on the piston, use a steam-engine "indicator" to make a diagram (below) showing the pressure at each point in the working and exhaust strokes.

Pressures on the working stroke (top line) help, those on the exhaust stroke (bottom line) hinder. The difference between the two (the vertical distance from the top line to the bottom) is the useful or "effective" pressure. The *average* useful pressure, called "mean effective pressure" or *MEP*, is the average difference between working-stroke and exhaust-stroke pressures.

To get this by direct measurement, as shown in Fig. 1, divide the diagram into vertical panels of equal width. Measure centerline height of each panel. Average these measurements to get the average height of the diagram.

If you have a planimeter, you can use it to measure area of diagram in square inches. Divide area by over-all length (in inches) to get average height.



To get average height of indicator card, divide into equal panels, measure center height of each panel, and average

FORM FOR FIGURING IHP

End, head or crank)	Indicator Diagram					N *(rev per min)*	*Factor*	*IHP (P x N × factor)*
	Area sq in.	*Length in.*	*Average height in.*	*Scale of spring lb per in.*	P *(mean eff press)*			
Head	1.21	3.83	0.316	80	25.3	225	.00713	40.6
Crank	1.24	3.83	0.324	80	25.9	225	.00693	40.4
Total								81.0

To convert this average height into mean effective pressure, you must know the "scale" of the spring used in the indicator. Suppose this is 60 lb (meaning pencil rises one inch for every 60 lb increase in pressure). Suppose, also, that the average height of the diagram is 0.4 in. Then the mean effective pressure will be 60 × 0.4 = 24 lb per sq in.

Figuring Horsepower

Multiply the mean effective pressure by the area of the piston to get the average total useful *force* acting on the whole piston. Then multiply this by the stroke (in feet) to get the foot pounds of work done per stroke. Next multiply by the number of working strokes per minute to get the foot pounds of work done per minute. To find the horsepower, divide this product by 33,000 because one horsepower equals 33,000 foot pounds per minute.

These operations are ordinarily written as a formula, like this:

$$HP = \frac{PLAN}{33{,}000}$$

This formula is simply an abbreviated statement of the following rule: Indicated Horsepower (figured separately for each end) = Mean Effective Pressure × Stroke (in feet) × Area of Piston (in sq.in.) × Working Strokes per Minute ÷ 33,000. The foregoing is the whole story except for certain convenient short cuts.

Figuring the Factor

Note that the formula:

$$IHP = \frac{PLAN}{33{,}000}$$

Can be written as:

$$IHP = \frac{L\,A}{33{,}000} \times P\,N$$

Since $\frac{L\,A}{33{,}000}$ never changes for a given end of a given engine, you can figure it out once and for all and call it the "Factor". Thereafter you can figure the *IHP* of either end as the product of its "Factor" by the mean effective pressure and the revolutions per minute.

Let's work out the factors for a simple double-acting engine of 15-in. bore, 16-in. stroke and 2½-in. piston rod, remembering that the area of a circle is its diameter squared times 0.7854.

Area of head end
= $(15)^2 \times 0.7854$ = 176.5 sq in.
Area of piston rod
= $(2.5)^2 \times 0.78$ = 4.9 sq in.
Area of crank end (difference) 171.6 sq in.
Stroke = 16 ÷ 12 = 1.333 ft.

Head-end factor $= \frac{L\,A}{33{,}000} = 1.333 \times 176.5 \div 33{,}000$
$= 0.00713$

Crank-end factor $= \frac{L\,A}{33{,}000} = 1.333 \times 171.6 \div 33{,}000$
$= 0.00693$

Next operation, if you want to be systematic, is to rule up a form like that shown, enter the data and compute across, left to right as shown. In first line (head end) you divide 1.21 by 3.83 to get 0.316, you multiply 0.316 by 80 to get 25.3, you multiply 25.3 by 225 and then by 0.00713 to get the head-end IHP 40.6. Follow same course for crank-end to get 40.4 IHP. Then add the two to get total of 81.0 IHP for engine.

ARGUMENT CORNER

Watertube Boilers

SOME OF THE ANSWERS on page 101, August, 1939, POWER, "Short Questions, Quick Answers on Watertube Boilers," are open to comment. For instance, one question was, "*What short nipples are used in B&W boilers?*" Forgotten were the short nipples between the steam drum and the headers on long-drum boilers (7- and 9-in. nipples), also that short nipples are used front and rear on B&W double-deck boilers to connect upper and lower sections, front and rear, on hundreds of older installations.

(Mr Spring admits he neglected inter-deck nipples in old installations, but says that riser and downcomer nipples between headers were purposely omitted as the limitation of "short" is quite debatable. Nipples 4 in. diameter by over 6 in. long are often not classed as long nipples).

"*Where, other than tube caps, are handholes required in sinous-header boilers?*" Besides the external mud drum mentioned in the answer, there are also handholes in the bridgewall supporting box, and in the superheater box or boxes for replacing and expanding the tubes.

"*What is an external mud drum for?*" Mr. Spring's answer was that it provides a chamber where sediment may be deposited out of rapid water circulation. Sediment is then removed by blowdown. He forgot that the mud drum also provides a place for removal, by hand through the handhole plates, of scale and sediment after turbining.

"*How is the cross-drum sinous header supported?*" The answer: by sling bolts at front end, cradles or riveted pads. However, many of the newer B&W boilers are supported at the front end in a heavy channel iron and built up to proper height by supporting I-beam legs. Also, many of the smaller and older model B&W's are supported at the rear end by a back wall or pedestal on which the mud drum rests, supported by cast-iron pads.

"*How is access to the various gas passes over the tubes gained?*" Answer: Through cleanout doors in the side wall, except in the standard Heine boiler. Here the baffles are "horizontal" and access is gained through a door on the boiler top on each side of the drum. However, I have noticed on many 2-drum Heines a small cleanout or access door high up in the rear wall between the headers. (Mr Spring does not consider this comment as common practice).

Aurora, Colo. E J DUFF

Feed Heating Started 40 Years Ago, Not 20

IN THE ARTICLE "ABC's of Feed Heating," page 62, January POWER, the author says that the idea of heating feedwater with bleed steam was born less than 20 years ago. This, however, does not hold true for the field of marine engineering.

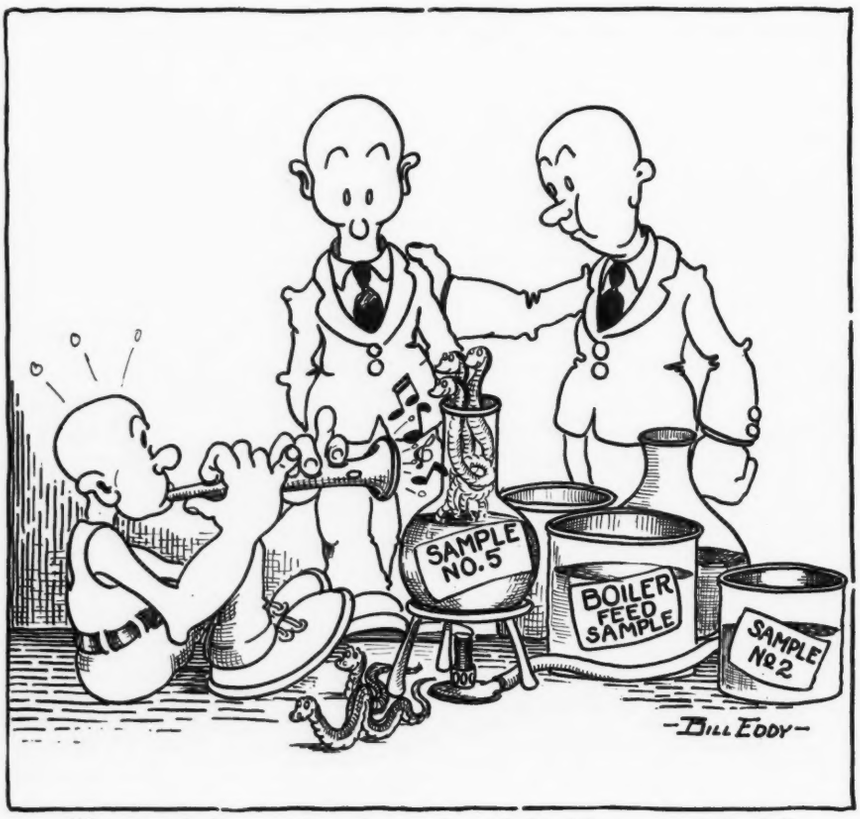
More than 40 years ago, I think Weir of Cathcart, Glasgow, made feedwater heaters that used bleed steam from the intermediate receiver. Granted this was single-stage heating, but at that time the principle was known and used on ships.

"Reed's Engineers' Handbook to the Board of Trade Examinations" (about 1902), page 355, shows a sample set of questions that involved use of empirical formulas to show, by bleeding 1/14 of the working steam from the intermediate receiver at 308 F, fuel consumption could be reduced 1.09%. The feedwater heater was a contact type. Crude mathematics, I must admit, but the principle was correct.

I was on a Belfast-built ship 36 years ago—the ship had been out 8 years then—and exhaust steam from the Weir feed pumps could be sent to the intermediate receiver. Another connection allowed intermediate steam to be used in a coil-type feedwater heater. (Digression: Those were the days when we often had to use salt water for boiler makeup).

San Francisco, Calif.
CHARLES HUBBARD

THE successful man does as he pleases. But he's darn careful what pleases him.—EXCHANGE.

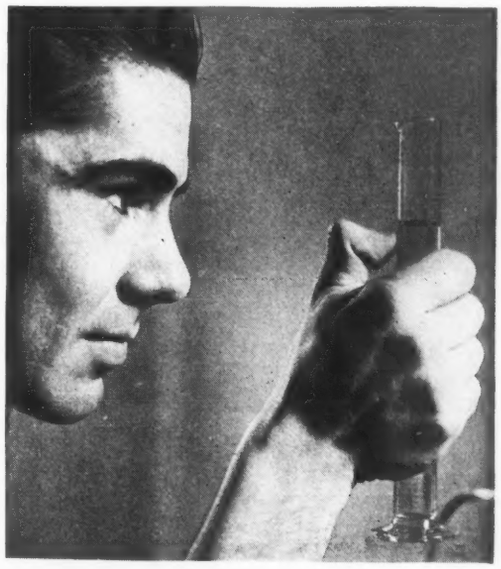


"Spargrove's been getting nice results with his 'algae control' lately"

HOW TO TEST FOR HARDNESS

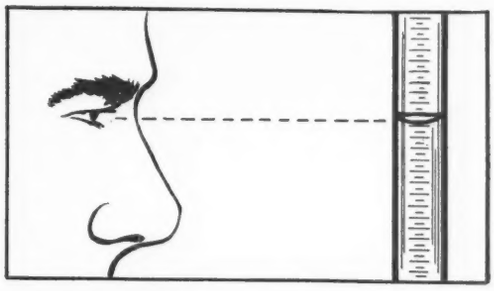
By C A NOLL
W H & L D Betz
(*Photos by* POWER)

Last month this page showed how to use the water test kit. Review directions and precautions there listed before proceeding with this soap test for hardness. The test for alkalinity will be explained in April and that for chlorides in May



1 →

Measure 50 cc (cubic centimeters) of the water in graduate. Bring bottom of miniscus exactly level with the 50-cc graduation. Sample should not be warmer than normal room temperature



1A →

Whether measuring in a graduate or a burette, always read liquid level at *bottom* of miniscus and on level with eye

← 2

Transfer sample to glass-stopered shaker bottle

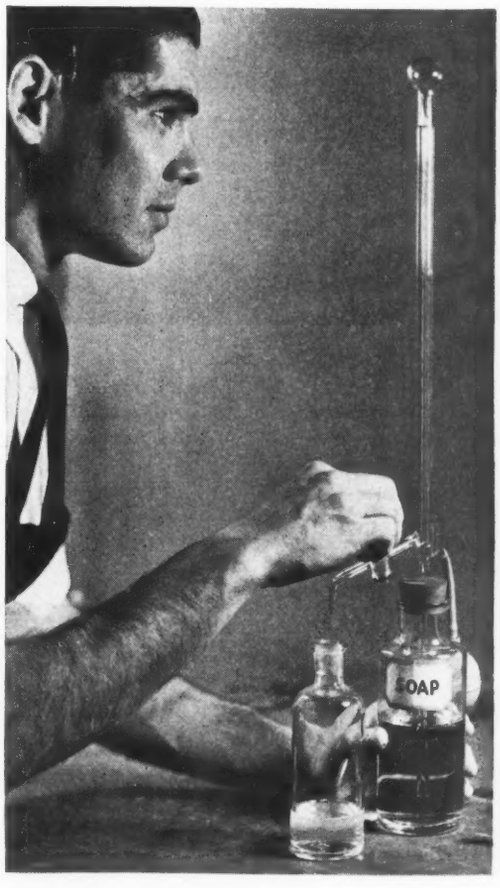
← 3

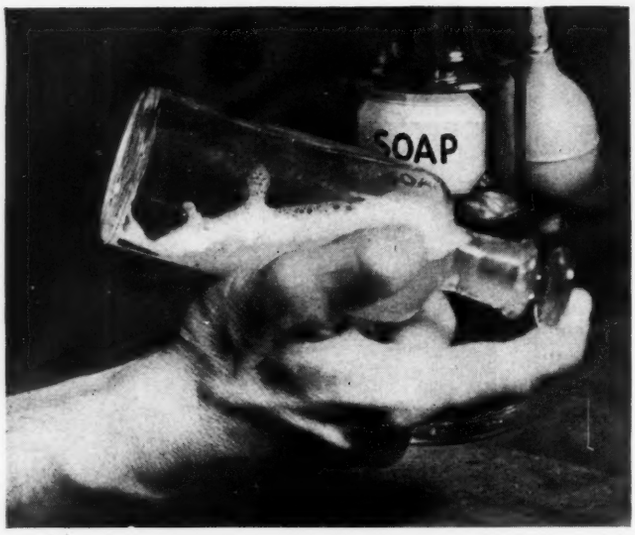
Fill burette with standard soap solution, 1 cc = 1 mg Ca CO_3 (see page 109, February POWER for detailed instructions for filling burette)

4 →

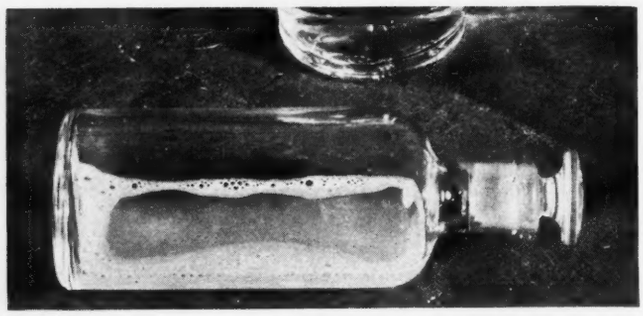
Let a quantity of soap equal to the "lather factor" run from burette into bottle. (The "lather factor" is always 0.3 cc, unless otherwise noted on the soap supply bottle). This amount of soap is just enough to produce a permanent lather with zero-hard water

(Continued on next page)



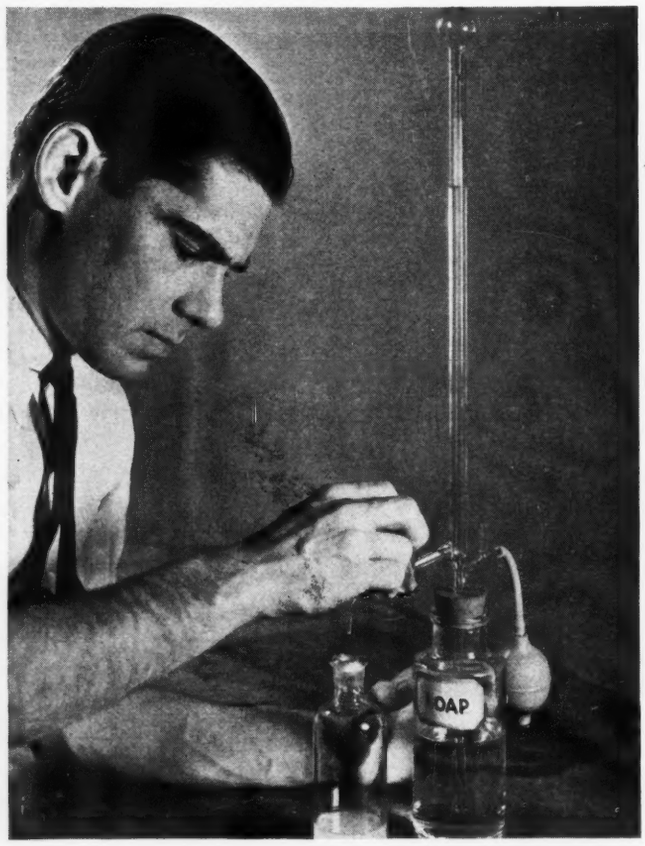


5 ↑ **Place glass stopper in bottle and shake sample**



6 ↑ **When lather forms, turn bottle on side and let stand. If lather still persists after five minutes, record "zero hardness" and the test is finished. (See photo 8 for satisfactory end-point lather)**

7 → **If lather disappears within five minutes, water contains hardness. Set bottle upright, remove stopper, add a little more soap solution. (See Note 2 for methods of speeding up without loss of accuracy). Again insert stopper, shake, lay on side and allow up to 5 minutes for lather to disappear**



8 ↓ **When lather no longer disappears within five minutes, stop adding soap and read the level in the burette very carefully**

9 **(No photo). Since 0.3 cc represents zero hardness, subtract this amount (0.3 cc) from the total quantity of soap used, to obtain the number of cc's corresponding to hardness. Multiply this net number of cc by 20 to get the hardness in parts per million (of calcium carbonate). For example, if final burette reading is 6.2 cc, subtract 0.3 cc to get 5.9 cc net soap solution used. Then hardness is 5.9 x 20 = 118 ppm**

Note 1—Before filling shaker bottle, rinse it preferably with distilled water, otherwise with water to be tested.

Note 2—The first soap test made may take a long time, if you add only a few tenths of a cc each time to avoid shooting over the mark. With more experience the tester can tell by the way the soap acts whether he is getting close to the "end point," so he can start with large doses of soap solution, cutting down to very small doses as he approaches the end point.

Here's another kink! After shaking, roll bottle slowly on table to carry lather to top side. If lather starts pulling apart quickly it shows that it will not last the required five minutes.

Note 3—Don't be fooled by a false or "ghost" end point. To make sure the apparent end point is correct, add another 0.3 cc and shake. If this lather stands, the previously indicated end point was true and final. If not, add more soap until a permanent lather is again obtained.

Note 4—If the total amount of soap required is more than 7 cc, the hardness of the water is too high to be measured correctly by testing a full-size sample. If this proves to be the case, start over again with a water sample of either 10 or 25 cc diluted to exactly 50 cc with *distilled* water. If the sample is diluted from 10 cc to 50 cc, multiply the test results by 5 to correct for the dilution. If sample is diluted from 25 cc to 50 cc, multiply the test result by 2.

You learned this exploring the attic *Remember?*

IT was years ago when you scrambled up onto old dirty trunks and lifted off the dust-laden lids of curious old boxes . . . remember? And remember your hands, and that clean new white suit . . . and what your good mother had to say about the dust and dirt that lays like a blanket where little boys are not supposed to go?

Well, little boys are not supposed to go inside the Motor Control in your factory today. In fact, your Motor Control should be so good that even those big boys who work with screwdrivers and pliers are supposed to pass that Motor Control by for months at a time without ever putting a finger inside it. And just as your mother said, *there* you will find a blanket of dust . . . dust and dirt in a layer on every *horizontal* surface.

Now that is very bad if the contacts in *your* Motor Control are horizontal, for everyone knows dirty contacts mean trouble. Cutler-Hammer engineers solved that problem a long time ago by designing *their* contacts to stand *vertical* so they can't collect dirt, so they *must* stay clean to *work* better and *last* longer. Cutler-Hammer is the *one* Motor Control that uses *vertical* contacts exclusively.

Don't you think you too should specify Cutler-Hammer and protect your Motor Control investment with good common sense? CUTLER-HAMMER, Inc., *Pioneer Electrical Manufacturers,* 1358 St. Paul Avenue, Milwaukee, Wisconsin.

CUTLER-HAMMER
MOTOR CONTROL
C-H

Insist on *Dust Safe* VERTICAL *Contacts*

Power Lines

$200,000 in Prizes for Papers on Arc-Welding

A $200,000 award program was announced in January by the James F Lincoln Arc Welding Foundation, Cleveland, Ohio. The program has been set up to pay out 458 prizes for studies bringing out benefits of a social, economic or commercial nature resulting from application of the electric-arc process of welding.

Awards, ranging from $13,700 to $100, and embracing 12 classifications and 46 divisions into which the industrial field has been divided for purposes of identification, consist of: 1st Grand award, $13,700; 3 main awards of $10,000, $7500 and $5000; 48 classification awards—1st, 2nd, 3rd and 4th awards of $3000, $2000, $1000 and $800 in each of 12 classifications; 184 divisional awards from $700 to $150; and 223 honorable mention awards of $100.

Of special interest to power engineers is the Maintenance Classification covering application of arc welding to maintenance of machinery and mechanical equipment, pipelines, etc. Participants have well over 2 years, from now until June 1, 1942, to pursue their studies and prepare reports summarizing them.

A 48-page booklet giving full particulars and explanation is available from the secretary, A F Davis, James F Lincoln Arc Welding Foundation, Cleveland, Ohio.

York Enters Turbo-Compressor Field

The entry of the York Ice Machinery Corp, York, Pa., into the field of turbo-compressor refrigeration was publicly announced on February 10 at a sales meeting in New York. York was a pioneer in the development and application of reciprocating refrigerating compressors and an extensive line of allied equipment.

The new turbo-units, available in capacities ranging from 150 to 1000 tons, are not intended to replace the reciprocating units, which will continue to be York's primary line, but rather to supplement them in places where the user can economically produce large amounts of refrigeration by steam-turbine power. The turbo units can also be driven by motors, usually through step-up gearing.

The new units have been developed through the combined efforts of the engineering organizations of the York Ice Machinery Corp and the Allis-Chalmers Mfg Co.

"No Coal Shortage"

To counteract any feeling that a coal shortage due to war conditions is prevalent in this country, the Department of the Interior, Consumer's Counsel Div, in the *Coal Consumers' Digest*, makes the following statements on the U. S. coal situation:

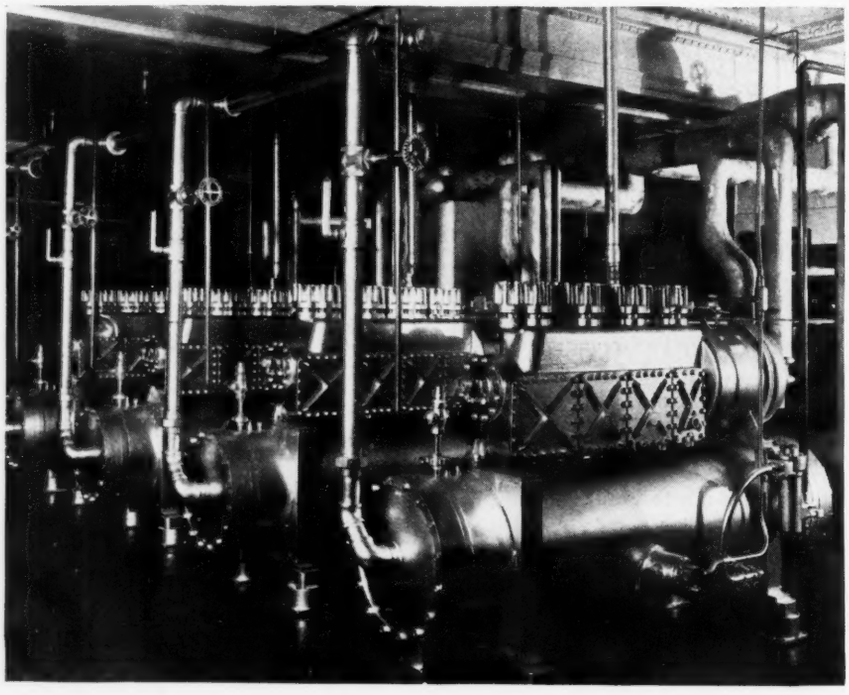
"It has come to the attention of the Consumers' Counsel Div that the European War has been used as an excuse for boosting prices of bituminous coal, on the ground that a shortage of bituminous coal exists or is impending".

"There is no truth to this contention, and any attempt to use it in advertising or sales promotion is false and misleading".

"The technical experts of this Division report that at the present time there is no unusual demand for coal due to the European War or any other causes. An increase in business for the coal concerns for a short time occurred at the outbreak of the War, but this increased demand has definitely receded and mine orders have returned to normal".

"At this time there is no prospect of a shortage of coal this winter and there is every reason to expect that there will be no change in the situation for a considerable time".

"With the closing of the Great Lakes to transportation there is actually a surplus of domestic coals with retail yards reporting the largest storage stocks on records. Stocks of industrial coal are also high. Many mines in the Appalachian fields are operating at 50% capacity because of poor demand".



AIR CONDITIONING SAVES

Two 100-ton CO_2 refrigerating machines requiring 250 hp, 1000 sq ft of space, and weighing 83 tons were replaced by four 40-ton condensing units having but 160-hp, needing 200 sq ft of space, and weighing ten tons. Air-conditioning costs were cut 30—40% for State Lake Theatre, Chicago. Each unit is hermetically sealed and has individual evaporator unit to equalize loading and simplify operation

1940 ASME Spring Meeting At Worcester, Mass., May 1

Sponsored by the Worcester section of the ASME, the 1940 Spring Meeting of that society will be held at the Hotel Bancroft, Worcester, Mass., May 1 to 3. The theme selected for this meeting is "Greater service to industry and the public," made more appropriate by the fact that the Worcester section will be celebrating the 25th anniversary of its founding.

The meeting will comprise 13 technical sessions, at which 26 papers will be presented, a general luncheon, an informal reception, and a banquet. Some of the papers which will be presented include "Feedwater Treatment", by C H Fellows, Detroit Edison Co; "Industrial Steam Power", W F Ryan, Stone & Webster Engrg Co; "Burning of Heavy Fuel Oil", G C Martinson, Sinclair Refining Co; "Purchase and Use of Fuels", E Wadsworth Stone, Bigelow-Sanford Carpet Co; "Determination of the Purity of Steam", M C Schwartz, W B Gurney, and Thomas E Crossan, Gulf States Utilities Co; "Modern Developments in Materials Handling", Russell Hastings, Lewis-Shepard Sales Corp; and "Cavitation Tests of Hydraulic Turbines", R E B Sharp, Baldwin-Southwark Div.

15,000-kw Turbine for Cedar Rapids Plant

A 15,000-kw extraction-condensing turbine, which, with assorted other improvements, will cost about $1,500,000, has been ordered for the Cedar Rapids plant, Iowa Electric Light & Power Co. It will operate at 650 lb, 750 F, and will mean increase of 15,000 kw in plant electrical capacity

75 YARWAY IMPULSE TRAPS *Serve* PEPPERELL

at Lindale, Georgia

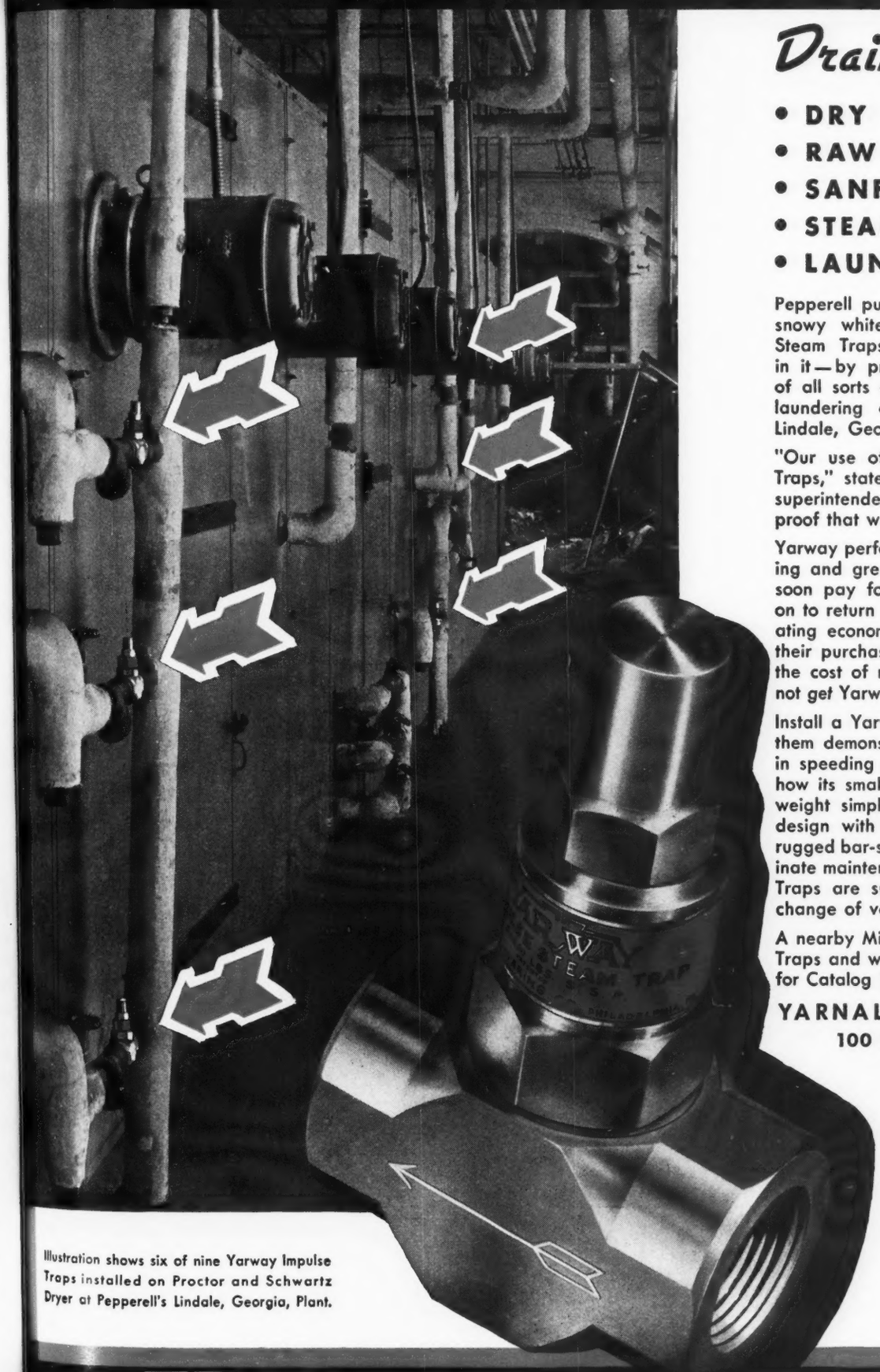


Illustration shows six of nine Yarway Impulse Traps installed on Proctor and Schwartz Dryer at Pepperell's Lindale, Georgia, Plant.

Draining

- **DRY CANS**
- **RAW STOCK DRYERS**
- **SANFORIZERS**
- **STEAM HEADERS**
- **LAUNDRY EQUIPMENT**

Pepperell puts the nation to sleep — between snowy white sheets. And Yarway Impulse Steam Traps are proud to have a hand in it — by providing more efficient operation of all sorts of steam-heated processing and laundering equipment in Pepperell's great Lindale, Georgia, Plant.

"Our use of this large number of Yarway Traps," states Mr. Comer Turley, mechanical superintendent of this plant, "is conclusive proof that we are well satisfied with them."

Yarway performance talks. Their quicker heating and greater sustained heating efficiency soon pay for their installation and continue on to return worth-while profits in plant operating economy. And when you consider that their purchase price is usually no more than the cost of repairing an ordinary trap — why not get Yarway performance for *your* money?

Install a Yarway Impulse Trap or two and let them demonstrate what they can do for you in speeding production and saving fuel. See how its small size saves space. How its light weight simplifies installation. How its unique design with only one moving part, and its rugged bar-stock construction, practically eliminate maintenance expense. Then too, Yarway Traps are suitable for all pressures without change of valve or seat.

A nearby Mill Supply Dealer handles Yarway Traps and will be glad to serve you. Or write for Catalog T-1734.

YARNALL-WARING COMPANY
100 Mermaid Ave., Phila.

YARWAY IMPULSE STEAM TRAP

and some immediate increase in steam capacity.

Feature of the turbine is that fact that it can be run either as straight condensing or bled at 210 lb for use in older turbines. Other improvements include new high-pressure boiler and new building to house the boiler.

American Chemical Society Meets April 8-12

The 99th meeting of the American Chemical Society will be held in Cincinnati, Ohio, April 8–12, with 17 of the Society's professional divisions participating. Dr Alfred Springer has been appointed honorary chairman of the convention, and Proctor Thomson is general chairman. Subjects to be discussed include the utilization of agricultural wastes, the combustion of solid fuels, the chemistry of insulation, cellulose plastics, and the future of chemistry as a specialized science in the high-school curriculum. Industrial research will feature the discussions.

North American System Will Spend $38,500,000

With major power-plant projects in each of the operating regions of the North American system, a program of construction is being planned which will cost almost double that spent in 1939. The total outlay will be almost $61,000,000, of which $38,500,000 will be spent in 1940, the balance being carried over into 1941. Plans call for new electric generating facilities with a total capacity of 265,000 kilowatts. A summary of the principal construction projects follows:

Missouri-Illinois-Iowa—New power plant in Venice, Ill., which together with new boilers in Ashley St plant in St. Louis, will add about 100,000 kw capacity to facilities of Union Electric Co and subsidiaries.

Ohio—New power plant adjoining the Cleveland Electric Illuminating Co's Lake Shore plant in Cleveland, with initial capacity of 63,000 kw.

Wisconsin-Michigan—Addition to Wisconsin Electric Power Co's Commerce St plant in Milwaukee and installation of new 35,000-kw unit and boiler equipment.

Kansas-Missouri—New power plant for the Kansas Power and Light Co at Abilene, Kan., with capacity of 15,000 kw, to cost $1,750,000, and installation of new 500-kw unit in Missouri Power & Light Co plant at Brookfield, Mo.

District of Columbia—Addition to Potomac Electric Power Co's Buzzard Point plant in Washington and new 50,000-kw unit. Estimated cost, $5,000,000.

New Boilers, Turbine, for Robert Gair Co, Inc.

Robert Gair Co, Inc, New York, have under way for a mill at Piermont, N. Y., the installation of new high-pressure steam generator, capacity 150,000 lb per hr, which will operate in conjunction with new 2000-kw topping turbine exhausting against 150-lb g pressure. The new turbine will drive, through reduction gears, a 100-kw ac generator and a 1000-kw dc generator. The boiler will also supply steam to an existing 2000-kw bleeder condensing turbine driving a 2000-kw ac generator. The steam generator will be fired with pulverized coal, and together with turbine, will be housed in new structure.

AVAILABLE THIS MONTH

A LIMITED NUMBER of Indexes to 1939 POWER. While the supply lasts, we will mail a copy to any subscriber requesting one. Address the Editor, POWER, 330 West 42nd St, New York, N. Y.

Midwest Power Conference April 9-10 in Chicago

The Midwest Power Conference, sponsored by the Armour Institute of Technology and seven mid-western universities, will be held in Chicago, April 9 and 10, in the Palmer House Hotel. Tentative program follows:

Tuesday, April 9

9:00 A M Registration

10:00 A M Opening Meeting
- Address of Welcome, Loran D Gayton, city engineer, Chicago, Ill.
- Response for the Cooperating Institutions

10:30 A M Power Fallacies, Philip W Swain, Editor, POWER

11:15 A M Gas Turbines

12:15 P M Joint Luncheon with A S M E

2:00 P M Small Power Plants
- (a) Diesel Units
- (b) Diesel vs Steam Units in Competitive Fields
- (c) Maintaining the Optimum in Steam Generator Efficiency, Parker A Moe, superintendent of power, Milwaukee Works, International Harvester Co
- (d) Discussion

3:45 P M Electrical Transmission
- (a) Protection of High Voltage Lines, Philip Sporn, vice president in charge of engineering, American Gas and Electric Service Corp, New York
- (b) Bus Arrangements and Switching
- (c) Electrical Distribution
- (d) Discussion

3:45 P M Power-Process
- (a) Paper Mill Power, Grover Keeth, Marathon Paper Mills Co, Rothschild, Wisconsin
- (b) Power for the Refinery, R L Meyer, superintendent of utilities, Whiting Refinery, Standard Oil Co
- (c) Power for the Chemical Plant
- (d) Discussion

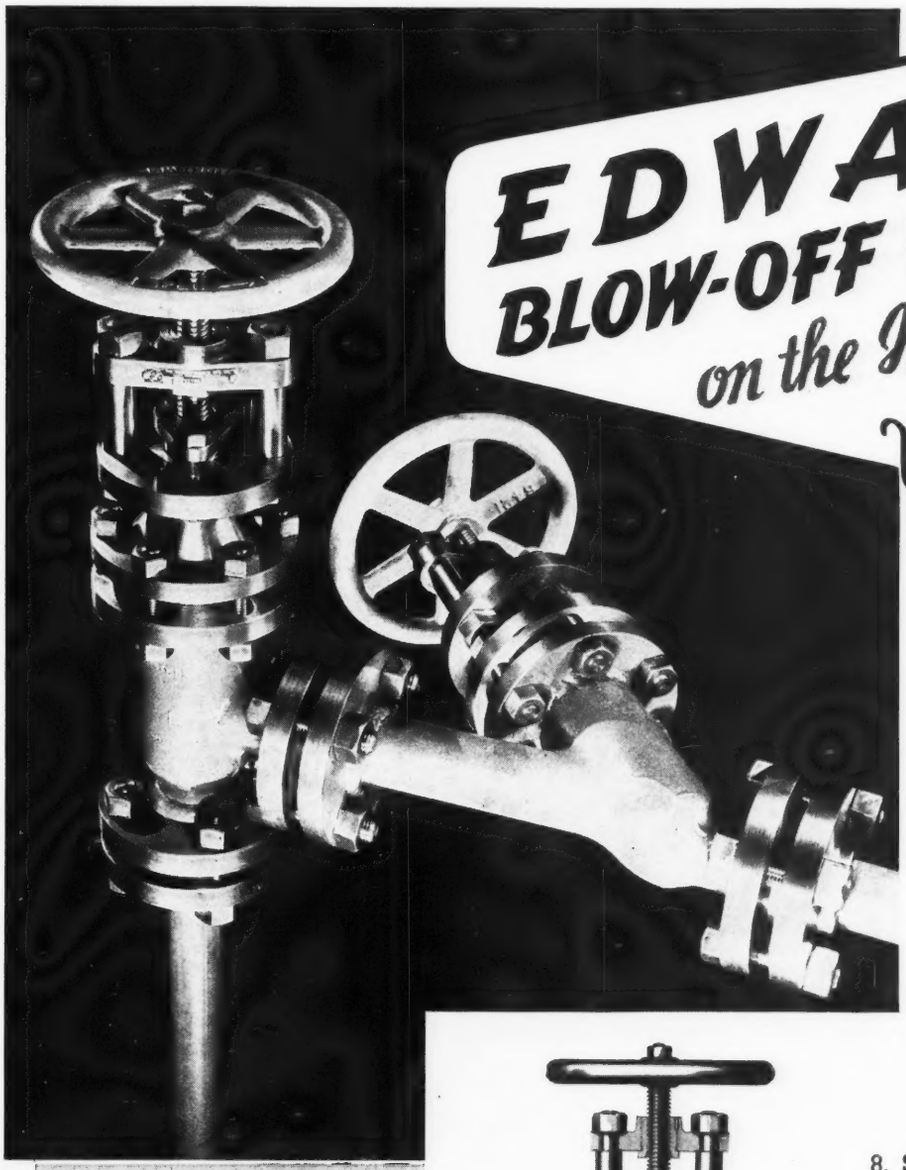
6:45 P M "ALL ENGINEERS" DINNER, Red Lacquer Room, Palmer House

Wednesday, April 10

9:30 A M Fuel Problems of Power Plants

SOMEWHERE IN FRANCE

Looking very much like a treadless tank is this sandbag-protected hydro unit "somewhere in France". French censor admits it's near the front, that it turns out blank kw and that it serves the Blank-Blank Works. British Combine photo



EDWARD BLOW-OFF VALVES on the Industrial Front

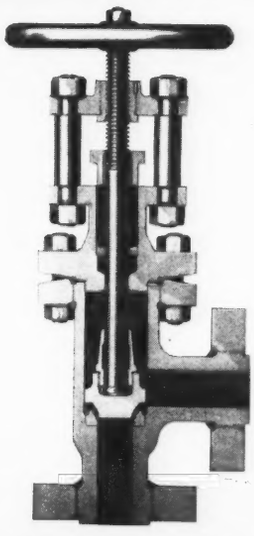
Winning with—

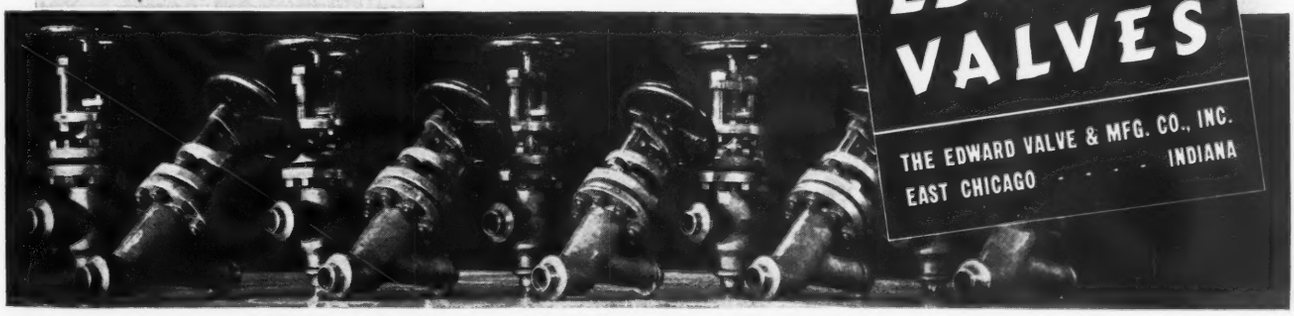
1. Globe type seating design—the tightest closure method.
2. Proportioned flow areas—no clogging or eroding.
3. Versatile use—power plant, marine, oil field, process piping.
4. Complete line — all pressures and sizes with proper 80% A.S.M.E. rating.
5. Adaptability—for any installation or space limitation.
6. Slow opening—no damaging shock.
7. Pedigreed, laboratory tested materials. (Non-contracting stem a real service feature).
8. Seats and disks of EValloy or Stellite hard faced.
9. Through bolted bonnets—best high temperature practice. Easy removal of parts.
10. Proved performance — Edward built the first high pressure blow-offs in 1904.

Complete elimination of non-essentials—accuracy in selecting and testing materials—rigid adherence to best machining practice—mark Edward blow-off valves. Study Edward Catalog 11-D. Two basic types and four pressure classes meet every piping option. Any combination can be easily and compactly welded together.

• • •

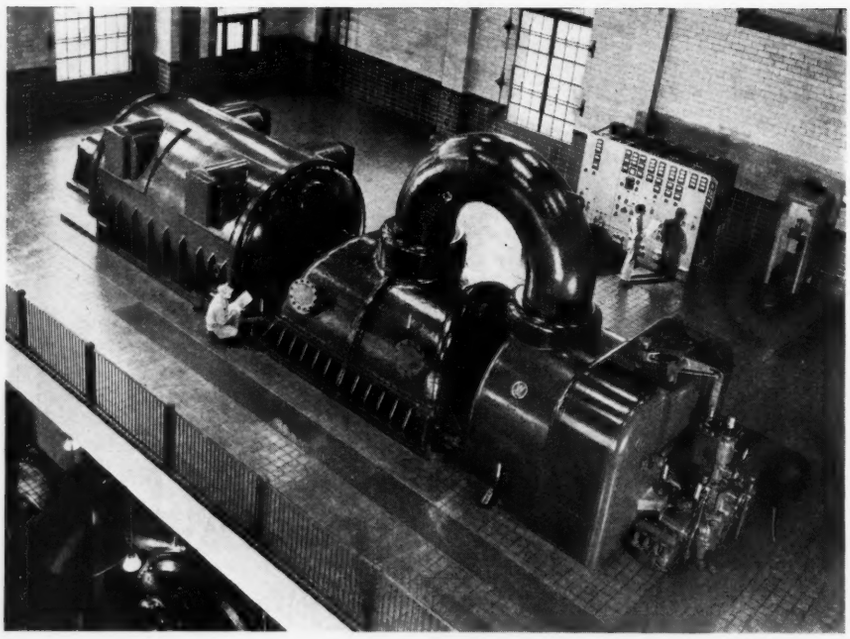
Photos show Edward straightway and angle blow-off valves with flanged and welding ends.





EDWARD VALVES

THE EDWARD VALVE & MFG. CO., INC.
EAST CHICAGO - - - - INDIANA



PENNSYLVANIA POWER

Generating unit at the new power house of the Pennsylvania Power Co, New Castle, Pa. 35,000-kw Westinghouse unit consists of 800-lb, 900-F, 3600-rpm tandem turbine and a hydrogen-cooled 14,400-volt generator

(a) Stratification of Gases in Coal-fired Furnaces, John M Drabelle, consulting engineer, Iowa Electric Light and Power Company, Cedar Rapids, Iowa
(b) Pulverized Coal, Martin Frisch, chief engineer, Boiler and Pulverizer Div, Foster Wheeler Corp, New York
(c) The Intermittent Burning of Gas and Pulverized Coal
(d) The Gas-fired Plant and its Problems E L Tindall, superintendent, Fuel and Combustion, Carnegie-Illinois Steel Corp, Chicago, Ill.
(e) Discussion

9:30 A M Hydro Power
(a) Small and Medium Sized Hydro Plants
(b) The Santee-Cooper Project, L F Harza, Harza Engineering Co, Chicago, Ill.
(c) The Hydrological Factors in the Design of a Dam, James S Bowman, Tennessee Valley Authority, Knoxville, Tenn.
(d) Discussion

12:00 Noon Joint Luncheon with A I E E
Speaker, L W W Morrow, editorial director, McGraw-Hill Publications, Chicago, Ill.

1:00 P M Inspection Trip

Superposing Would Double Power Capacity, Says Smith

Generating capacity of the nation's steam power plant can be almost doubled with only one-third more fuel consumption by superposing steam and mercury turbines on existing units, says A R Smith, managing engineer, General Electric Co, Turbine Div. 12 million kw can be added by "topping" existing units with steam turbines, and another 11½ million kw can be obtained by superposing with mercury turbines.

In a speech before the combined engineering societies of Schenectady, N. Y., he also said that recent improvements have enhanced the reliability of the mercury-vapor plant, better steel in boilers enabling them to withstand temperatures and pressures greater than previous carbon-steel types.

Meetings

American Society of Mechanical Engineers—*Spring Meeting, May 1–3, 1940, Worcester, Mass. C E Davies, secretary, 29 W 39th St, New York, N. Y.*

American Society for Testing Materials—*Spring Meeting, March 6th, 1940, Detroit, Mich. C L Warwick, secretary-treasurer, 260 S Broad St, Philadelphia, Pa.*

Midwest Power Conference—*Palmer House Hotel, Chicago, Ill., April 9–10, 1940. Charles A Nash, secretary of 1940 conference, 4715 N Spaulding Ave, Chicago, Ill.*

National District Heating Assn—*Annual Meeting, May 14–17, 1940, French Lick Springs Hotel, French Lick, Indiana. John F Collins, Jr, secretary-treasurer, 1231 Grant Bldg, Pittsburgh, Pa.*

Heating, Piping and Air Conditioning Contractors National Association—*Annual Convention, May 27–30, Hotel Pennsylvania, New York, N. Y. Joseph C Fitts, secretary, 1250 Sixth Ave, New York, N. Y.*

Smoke Prevention Association—*Annual Convention, May 21–24, Hotel Statler, St. Louis, Mo. Headquarters Office, City Hall Square Bldg, Chicago, Ill.*

Stoker Manufacturers Assn.—*Annual Meeting, June 6–7, Homestead Hotel, Hot Springs, Va. Headquarters Office, 307 N Michigan Ave, Chicago, Ill.*

International Acetylene Association—*40th Convention, April 10–11–12, 1940, Schroeder Hotel, Milwaukee, Wis. Headquarters Office, 30 East 42nd St, New York, N. Y.*

Sweden Opens Newest Hydroelectric Plant

A new water-power station, built, owned and operated by Swedish Government Waterfalls Board, has been partly put into operation at Stadsforsen, on the Indal River in northeastern Sweden. Power is transmitted to central Sweden at 220,000 volts. About 40,000 kw are fed into the power net by the Stadforsen plant, which cost more than $5,000,000. Because of the station, steam power production will be reduced about 5,000,000 kwhr per week, effecting a weekly coal saving of about 3500 tons.

OBITUARIES

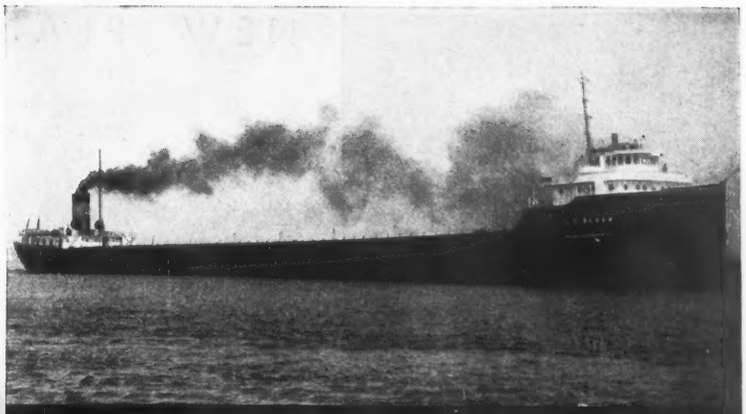
JOHN W MACMEEKEN, one of the senior designing engineers of Ingersoll-Rand Co, died at his home in Easton, Pa., on December 29, 1939. He was 51 years of age. He was born in Scotland, was a graduate of the University of Edinburgh, and served two years in the war. Following the war he entered the employ of the Montreal Light, Heat & Power Co. He joined the present company in 1937, when he entered the engineering staff, and at the time of his death was serving as one of senior design specialists in the company's Cameron Pump Div at Phillipsburg, N. J.

COL ARTHUR F TOWNSEND, chairman of the board of Raybestos-Manhattan, Inc, and general manager of Manhattan Rubber Mfg Div, Passaic, N. J., died on Jan. 14, 1940 at his home in Ridgewood, N. J. A graduate of the Massachusetts Institute of Technology, he began work as shipping clerk with the New York Belting & Packing Co, rising to assistant manager at Passaic. He served nine years with that company. Later, with several other men, he organized the Manhattan Rubber Mfg Co, was successively secretary and vice-president. In 1903 he was made president of the company, serving from 1903 to 1929. Since 1929 he had been chairman of the board of Raybestos-Manhattan, Inc, and general manager of the Manhattan Rubber Mfg Div.

A H BLACKBURN, assistant sales manager of the Riley Stoker Corp, passed away recently. He was general manager of the Green Fuel Economizer Co from 1893 to 1914, when he became chief engineer of the Underfeed Stoker Co of America. In 1922, when the Underfeed Stoker Co was absorbed by Riley Stoker Corp, Mr Blackburn became assistant sales manager, which position he held until the time of his death. He was a life member of the ASME.

THOMAS HAWLEY, 73, founder of the Hawley School of Engineering, Boston, Mass., died in that city on Jan. 20, 1940. He was born in Boston and in 1893 was commissioned by the governor to organize

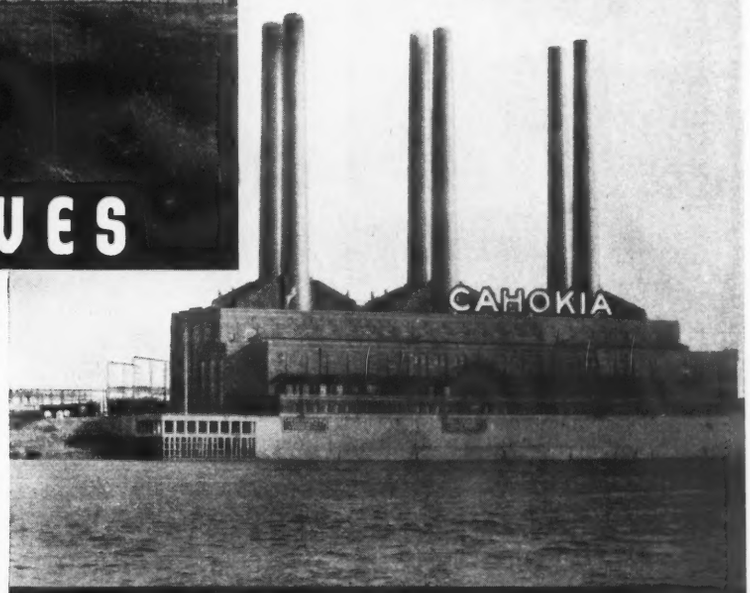
Economical Operation of-



STEAMSHIPS

LOCOMOTIVES

must be continuous and free from trouble!

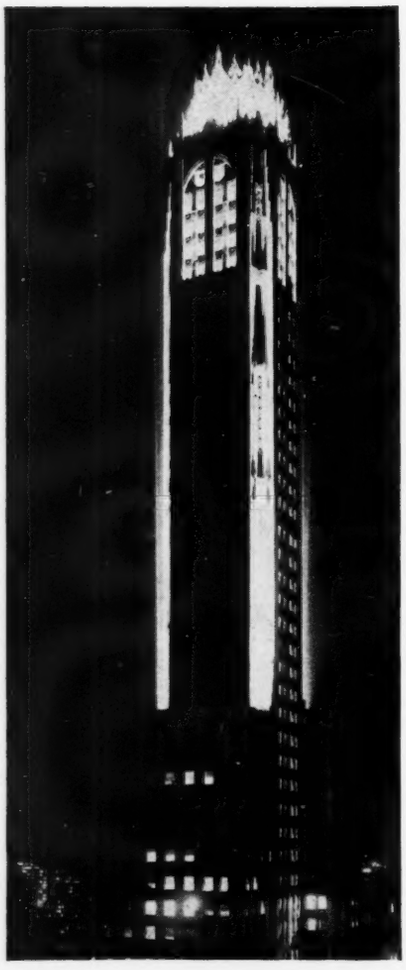


and POWER PLANTS

—Perhaps that is why so many are using: THE Nalco SYSTEM OF FEEDWATER TREATMENT

WHEN you have heavy schedules to meet, you do not want to take chances on any operating condition that may cause an interruption. For maximum protection against POWER FAILURE, make sure that your precautions include use of the Nalco System. For complete information, write NATIONAL ALUMINATE CORP., 6222 W. 66th Place, Chicago, Ill.

Inquiries other than domestic *except those from U. S. Possessions, Canada and Mexico,* should be addressed to ALFLOC LTD., Bush House, Aldwych, London, W. C. 2, Eng. Canadian inquiries should be sent to ALUMINATE CHEMICALS LTD., 372 Bay St., Toronto, Ont.



100,000,000 CANDLEPOWER

Four searchlights, each using three 1000-watt water-cooled mercury lamps no bigger than a cigarette, turn General Electric Bldg in New York into a 50-story flaming candle

the Mass. Dept of Boiler Inspection, being appointed chief examiner of engineers and boiler inspectors. He retired from active work with the school about five years ago.

PERSONALS

ALEX DOW, formerly president of the Detroit Edison Co, was elected chairman of the executive committee at the organization meeting of directors held in New York, February 6, 1940. Alfred C Marshall, former vice-president and general manager, was selected president to succeed Mr Dow.

JOHN R WILLIAMS, associated with the Electric Storage Battery Co for the past 45 years, announced his retirement as president. R C Norberg, vice-president and general manager, was elected president and general manager.

R LEHR has recently been appointed sales manager of the Quincy Compressor Co, Quincy, Ill. He joined the company in 1933 and until his recent promotion

(Continued on Page 140)

NEW PLANT CONSTRUCTION

McGraw-Hill Business News Department Is Prepared to Furnish a More Complete Daily Service

Ala., Mobile—Alabama Power Co., Commonwealth & Southern, 600 N. 18 St., Birmingham; plans by I. Moscowitz, Bona Allen Bldg., Atlanta, Ga., constructing extensions and alterations to Chicksaw plant, remodeling present 1 story building, 66 ft. high, new 1 story, 80x80 ft. boiler house. $3,000,000. Commonwealth & Southern, 600 N. 18 St., Birmingham, engrs.

Ariz., Morenci—Phelps Dodge Corp., 40 Wall St., New York, N. Y., constructing copper smelting plant, owner builds; steel work, to Kansas City Structural Steel Co., 21 St. and Metropolitan Ave., Kansas City, Mo. Est, $15,000,000.

California—San Diego Consolidated Gas & Electric Co., Electric Bldg., San Diego, plans expending $2,809,905 during 1940, for new power source, new power house, installing 35,000 kw. generator complete with boilers and switching equipment or alternate constructing 132,000 volt interconnecting link with a northern company, proposed high tension transmission line will terminate at a new Mission Valley substation latter plan will, if used, indirectly tap power source at Boulder Dam.

Colo., Pueblo—Southern Colorado Power Co., W. N. Clark, pres., Colorado Bldg., plans doubling generating capacity of steam plant. $1,000,000.

Connecticut—Connecticut Light & Power Co., C. L. Campbell, pres., 36 Pearl St., Hartford, plans 1940 power construction program, expansion power facilities of company, installing 15,000 kva. synchronous condenser, Waterbury: wharf and coal handling facilities. Devon: addition to Black Rock Station, New Britain: addition to power substation, Norwalk. $2,600,000. Private plans.

Ga., Macon—Georgia Power Co., Commonwealth & Southern, 600 N. 18 St., Birmingham, Ala., plans altering present building and additions, present building, 1 story, 50 ft. high, new 1 story 80x80 ft. boiler house, structural steel, brick walls. $3,000,000. Robert & Co., Bona Allen Bldg., Atlanta, consult. engrs.

Ill., South Elgin—Winnebago Distilling Co., c/o P. Gerhardt, archt., 447 Fullerton Parkway, Chicago, taking bids on revised plans constructing group distillery buildings. $1,000,000.

Ia., Cascade—Bids Mar. 12, by F. A. Kurt, city clk., furnishing, installing electrical equipment, switchboard, bus structure cable and wiring for power plant. Total est. $110,000. Stanley Eng. Co., Muscatine, engrs.

La., Lake Charles—Continental Oil Co., D. Moran, pres., Ponca City, Okla., will construct 8,000 bbl. oil refinery, by own forces. $4,000,000. Private plans.

Md., Hagerstown—R. H. Sweeney, mayor, making surveys installing new boilers at municipal light plant. $260,000. Engineer not appointed.

Michigan—Consumers Power Co., Jackson, completing John C. Weadock steam power plant in vicinity Bay City, installing 35,000 kw. unit, constructing 1,200 mi. rural transmission lines, new power supply lines for West Branch, Roscommon, Frankfort, Morenci, Cement City and Adrian, 140,000 volt line from Lansing to Flint, new transmission line from Croton Dam to Belding and Ionia, addition to offices, service building, and garages in Lansing, garage and service station Battle Creek. $14,000,000. Private plans.

Minn., Kettle River—Carlton Co. Cooperative Power Assn., T. Ross, secy., bids latter part of February, constructing 1 story, bsmnt. 50x150 ft. brick, concrete power house, equipment for generating power to supply rural electric distribution system, two 200 kw. diesel generators. $90,000. United Eng. Co., 1406 W. Lake St., Minneapolis, engrs.

Minn., Mankato—Blue Earth-Nicollet Co-op. Electric Assn., Mankato, E. M. Nash, supt., plans constructing brick, concrete generating plant, probably diesel, to supply power for distribution system. $40,000-$75,000. Ellerbe & Co., E. 1021 1st Natl. Bank Bldg., St. Paul, engrs.

Minn., St. Paul—Northern States Power Co., R. F. Pack, pres., H. H. Watson, genl. constr. supt., 15 S. 5 St., Minneapolis, and G. O. House, mgr., 5 and Wabasha Sts., St. Paul, plans constructing rein.-con., brick building for new generator plant on site next to owner's High Bridge plant, Mississippi River. Over $3,000,000. Private plans.

Miss., Meridan—Flintkote Co., 50 W. 50 St., New York, N. Y., plans constructing about 300-1200 ft. concrete, steel plant for manufacture insulation board, on 250 acre site adjacent to city of Meridian. $2,000,00, incl. equipment.

Neb., Hastings—City plans improving light and power plant, 3,500 kw. generator. $280,000. Black & Veatch, 4706 Bway., Kansas City, Mo., engrs.

N. J., Camden—Pub. Serv. Electric & Gas Co., 80 Park Pl., Newark, plans by F. P. Fairchild, 80 Park Pl., Newark, constructing brick switching station, Crescent Blvd. (Route 25) to house 30,000 kilovolt ampere transformer bank and 8-26 kilovolt supply lines to transmit electricity to nearby substations. $577,000.

N. J., Trenton—Pub. Serv. Electric & Gas Co., 80 Park Pl., Newark, plans by F. P. Fairchild, 80 Park Pl., Newark, constructing brick switching station with electrical equipment for transforming and transmitting electricity to nearby substations. $754,000.

N. Y., Plattsburgh—City, City Hall, bids in March, constructing Contrs. 2, 3, 4, 5 and 6, electric generation station. Bids later for distribution system and equipment. Total est. $520,000. Burns & McDonnell, 107 W. Linwood Blvd., Kansas City, Mo., consult. engrs.

N. Y., Utica—Utica Knitting Co., 1712 Erie St., plans constructing power plant, addition. Over $50,000. Gibbs & Hill, Penna Sta., New York, engrs.

N. D., Fargo—Northern States Power Co., 15 S. 5 St., Minneapolis, Minn., plans constructing power plant and distribution system improvements. $90,000.

O., Akron—Bids about Mar. 1, by B. F. Goodrich Co., 500 S. Main St., 3 story brick, steel concrete factory unit, $200,000. Private plans.

O., Akron—Ohio Edison Co., A. C. Blinn, pres., 47 N. Main St., plans constructing plant additions and expansions. $6,500,000. Private plans.

O., Columbus—Columbus & Southern Ohio Electric Co., 215 N. Front St., expending $3,097,757 during 1940, for constructing generating plants, $199,830, substations, $558,980, transmission lines, $73,175, new services, $56,000, distribution lines, $307,500, transformers and installations, $90,000, meter and installations, $199,500, miscellaneous additions to company property. $145,945.

Okla., Sand Springs—Sand Springs Cotton Co., Sand Springs, final plans made, constructing new building and textile machinery for mill, $500,000. J. E. Sirrine, Greenville, S. C., engr.

Ore., Eugene—Eugene Water Bd. plans constructing 7,500 kw. steam stand-by power plant adjacent to present plant at end 8 Ave. J. W. McArthur, supt Water Bd. $510,000.

Ore., Lebanon—Evans Products Co., M. D. Tucker, mgr., 15310 Fullerton St., Detroit, Mich., plans constructing plywood plant, near here. $1,000,000.

Ore., Portland—Portland General Electric Co., Electric Bldg., 1940 construction budget; repairing steam generating plants, $5,000; constructing hydro-electric plants $123,000, substations $468,300, transmission lines $128,600, distribution lines $800,700, miscellaneous $43,200, substations, 7 in Portland, 2 largest are N.E. 38 Ave. and Clackamus St. $50,000, and N. Lombard and McCrum St. $40,000, Salem $11,000, other substations Newberg, Sherwood, Burlington, Greshham and Jennings Lodge; new flume for hydro electric plant at Cazadero; distribution lines, Portland Div. $337,000. Willamette Valley Div. $77,000, Tualatin Valley Div. $53,000, Yamhill Div. $49,000, Vancouver, Wash. Div. $10,000, Molalla Div. $25,000, Oregon City Div. $29,000, Gresham Div. $24,000, St. Helens Div. $11,000. Total est. $1,568,000. W. Brenton, Electric Bldg., engr.

Pa., Marcus Hook—Sun Oil Co., 1608 Walnut St., Phila., and Blawnox, plans constructing refinery. $4,300,000.

Tenn., Savannah—Tennessee Valley Paper Mills, Inc., S. W. Duggan, secy.-treas. 720 Market St., Knoxville, plans constructing paper mill. $4,100,000. Engineer and architect not appointed.

Tex., Brownsville—Woburn Industries, c/o Farm Bureau, M. D. L. Van Ouer, exec. dir. Harrison, will not take formal bids, those interested should communicate with owners direct for processing plant to utilize castor tree for manufacture of castor by-products. $150,000.

Tex., Mineral Wells—Brazos River Conservation & Reclamation Dist., J. A. Norris, genl. mgr., c/o Kyle Hotel, Temple, plans completing Possum Kingdom Dam projects, incl. hydro electric power plant, $4,200,000 less $1,000,000 used for outside work.

Wis., Milwaukee—Wisconsin Electric Power Co., 231 W. Michigan St., plans constructing 15,000 kva. sub-station, N. 96 St., 90,000 kva. transformer bank, N. 28 St. $700,000. F. Luber, c/o owner, archt.

Wis., Wilson—Wisconsin Oil Refining Co., 225 E. Michigan St., Milwaukee, plans constructing oil refining plant, $700,000 to $750,000.

N. B. Moncton—Canadian National Ry., C. B. Brown, ch. engr., 360 McGill St., Montreal, Que., plans constructing locomotive shops. $500,000. Site purchased. Private plans.

South America, Brazil—United States Steel Corp., 71 Bway., New York, N. Y. and United States of Brazil, Rio De Janiero, plan constructing steel mill in Minas Geraes State. $35,000,000.

South America, Chile—American Commercial Attache, Santiago, reports a previously projected hydro-electric plant at Falls of Pilmaiquen, near Osorno in south central Chile, is again being actively agitated owing to need for industrial power in that area.

20 YEARS AT HARD LABOR!

Lo-Maintenance Motors Set Outstanding Low Cost Performance Record! Find Out How You Can Get Extra Dollar-for-Dollar Value . . . with Full Measure Constructed Lo-Maintenance Motors!

HERE'S THE LO-MAINTENance Motor that set a record of 20 years on the job with no time outs for repairs. And it's still going strong today!

If you are like executives who want the most from the equipment they buy . . . you've acquired the "long view." You want to know what your equipment will do . . . not only today . . . but for years to come!

Back in 1919, a large mid-western brewery bought an Allis-Chalmers Lo-Maintenance Motor. They figured it was a good investment . . . but they never realized the dividend that Lo-Maintenance Motor would pay them in staying on the job with no time-outs for repairs!

They didn't pamper that motor! They put it in a spot exposed to heat and moisture . . . hooked it to a pump . . . and put it to work 24 hours a day!

Not One Cent for Repairs!

Today—20 years later—here's the record! Not one cent has been spent for motor repairs! But that's not all! That Allis-Chalmers Lo-Maintenance Motor is doing as good a job for that brewery as the day it was installed!

That's why the chief engineer standardizes on Lo-Maintenance Motors in his plant. And that's why Lo-Maintenance Motors are fast becoming standard equipment in hundreds of other plants throughout the country.

You'll like the protection against breakdowns the high carbon steel frame and indestructible rotor and distortionless stator give you! The full Measure Construction with no skimping on materials that means longer life . . . less servicing . . . extra years of trouble-free service!

Get the whole story of the motor with more than just a rated horsepower . . . the motor that actually beats conditions that many times wreck ordinary motors! Call the trained production engineer in the Allis-Chalmers District Office near you. Let him show you how you can cut frequent time outs . . . reduce man hours lost due to motor failures . . . get longer motor life . . . with Allis-Chalmers Lo-Maintenance Motors!

A1129

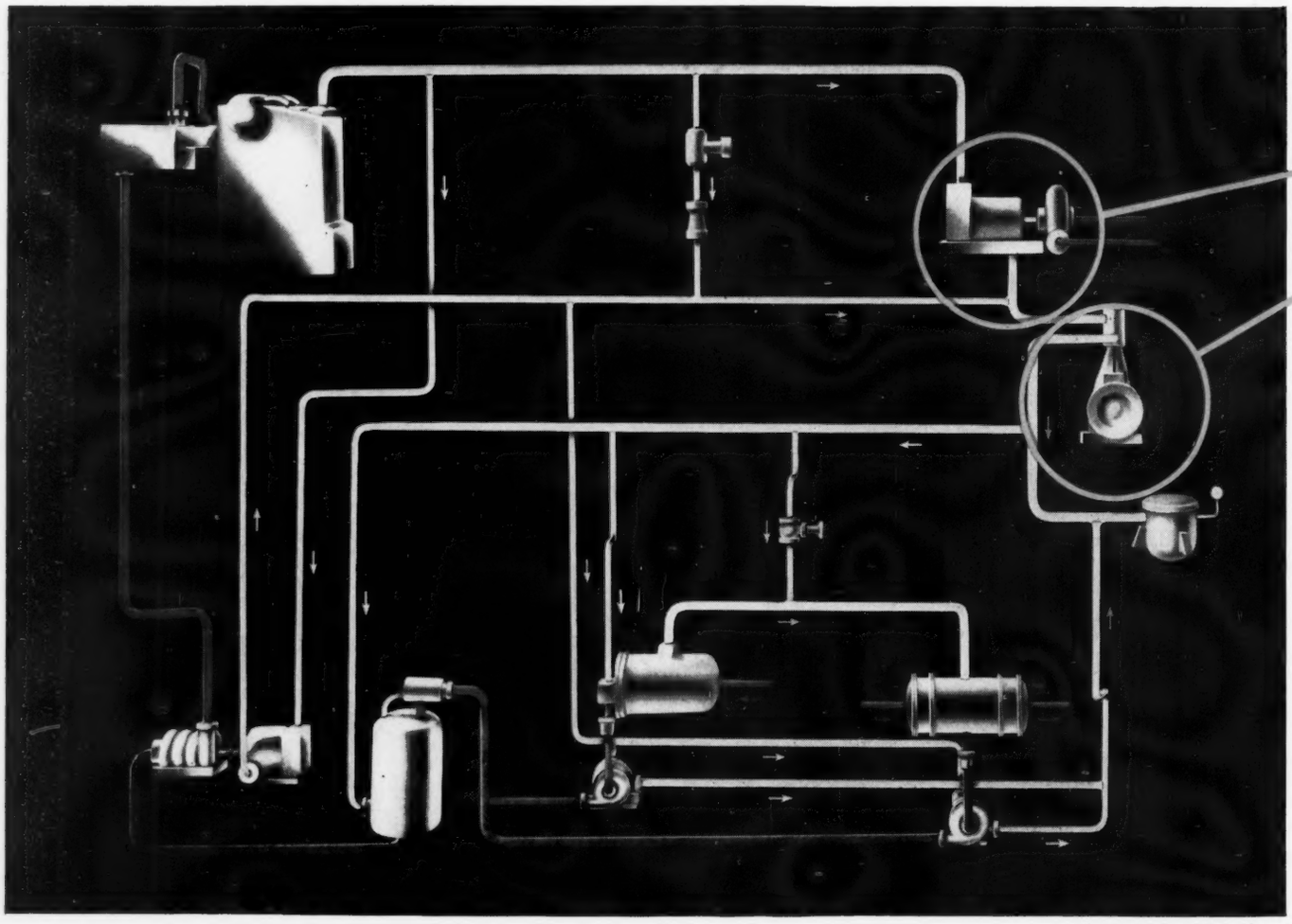
Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

FROM *GOOD* POWER HOOKUPS

FOR AUXILIARY DRIVES . . .



Courtesy—Power Magazine

HOOKUP #16 **Transmitting h-p steam to equipment drives that act as reducing valves, thereby furnishing l-p steam to adjacent processes, proves most economical in this oil refinery power-plant. Turbines driving large pumps exhaust at intermediate pressure to engine drives and process; additional i-p steam is supplied by auxiliaries and a reducing valve. Low-pressure exhaust supplies process, de-aerating heaters and evaporators. Evaporator steam and excess l-p steam are condensed for makeup.**

THE REFINERY power-plant shown in the complete hookup above is ideally suited to illustrate the use of auxiliary turbines and engines utilizing steam at more than one pressure.

You will note also, from checking the diagram and Jenkins Figure Number table that the valve functions and connections remain the same—regardless of pressure.

In other words, you can use this data as a practical guide for selecting and installing valves on *any* of your auxiliary steam driven equipment.

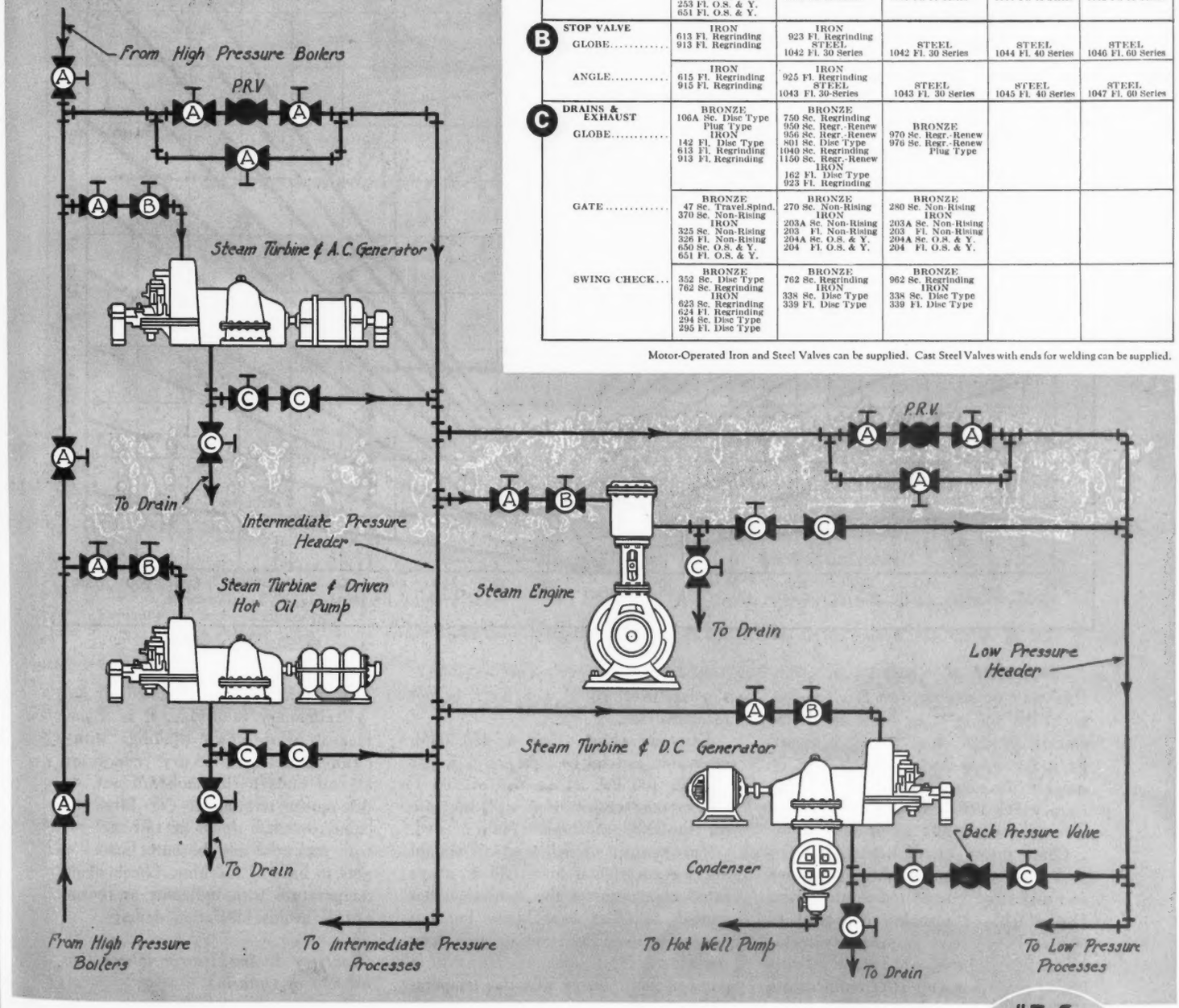
NEXT MONTH—STEAM STORAGE

IN VALVES *Jenkins* GIVES YOU EVERYTHING

. . . TO *GOOD* VALVE PRACTICE

Jenkins RECOMMENDS . . .

STEAM CONNECTIONS FOR TURBINES AND ENGINES



REFERENCE CHART TO JENKINS FIGURE NUMBERS FOR AUXILIARY DRIVE EQUIPMENT

		100 lbs. S.P.	Up to 200 lbs. S.P.	Up to 300 lbs. S.P.	Up to 400 lbs. S.P.	Up to 600 lbs. S.P.
A	STEAM HEADER					
	GLOBE	IRON 142 Fl. Disc Type 613 Fl. Regrinding 913 Fl. Regrinding	IRON 162 Fl. Disc Type 923 Fl. Regrinding STEEL 1042 Fl. 30 Series	STEEL 1042 Fl. 30 Series	STEEL 1044 Fl. 40 Series	STEEL 1046 Fl. 60 Series
	ANGLE	IRON 144 Fl. Disc Type 615 Fl. Regrinding 915 Fl. Regrinding	IRON 163 Fl. Disc Type 925 Fl. Regrinding STEEL 1043 Fl. 30 Series	STEEL 1043 Fl. 30 Series	STEEL 1045 Fl. 40 Series	STEEL 1047 Fl. 60 Series
	GATE	IRON 251 Sc. Non-Rising 255 Fl. Non-Rising 277 Sc. O.S. & Y. 253 Fl. O.S. & Y. 651 Fl. O.S. & Y.	IRON 204 Fl. O.S. & Y. STEEL 1010 Fl. 30 Series	STEEL 1010 Fl. 30 Series	STEEL 1011 Fl. 40 Series	STEEL 1012 Fl. 60 Series
B	STOP VALVE					
	GLOBE	IRON 613 Fl. Regrinding 913 Fl. Regrinding	IRON 923 Fl. Regrinding STEEL 1042 Fl. 30 Series	STEEL 1042 Fl. 30 Series	STEEL 1044 Fl. 40 Series	STEEL 1046 Fl. 60 Series
	ANGLE	IRON 615 Fl. Regrinding 915 Fl. Regrinding	IRON 925 Fl. Regrinding STEEL 1043 Fl. 30-Series	STEEL 1043 Fl. 30 Series	STEEL 1045 Fl. 40 Series	STEEL 1047 Fl. 60 Series
C	DRAINS & EXHAUST					
	GLOBE	BRONZE 106A Sc. Disc Type Plug Type IRON 142 Fl. Disc Type 613 Fl. Regrinding 913 Fl. Regrinding	BRONZE 750 Sc. Regrinding 950 Sc. Regr.-Renew 956 Sc. Regr.-Renew 801 Sc. Disc Type 1040 Sc. Regrinding 1150 Sc. Regr.-Renew IRON 162 Fl. Disc Type 923 Fl. Regrinding	BRONZE 970 Sc. Regr.-Renew 976 Sc. Regr.-Renew Plug Type		
	GATE	BRONZE 47 Sc. Travel.Spind. 370 Sc. Non-Rising IRON 325 Sc. Non-Rising 326 Fl. Non-Rising 650 Sc. O.S. & Y. 651 Fl. O.S. & Y.	BRONZE 270 Sc. Non-Rising IRON 203A Sc. Non-Rising 203 Fl. Non-Rising 204A Sc. O.S. & Y. 204 Fl. O.S. & Y.	BRONZE 280 Sc. Non-Rising IRON 203A Sc. Non-Rising 203 Fl. Non-Rising 204A Sc. O.S. & Y. 204 Fl. O.S. & Y.		
	SWING CHECK	BRONZE 352 Sc. Disc Type 762 Sc. Regrinding IRON 623 Sc. Regrinding 624 Fl. Regrinding 294 Sc. Disc Type 295 Fl. Disc Type	BRONZE 762 Sc. Regrinding IRON 338 Sc. Disc Type 339 Fl. Disc Type	BRONZE 962 Sc. Regrinding IRON 338 Sc. Disc Type 339 Fl. Disc Type		

Motor-Operated Iron and Steel Valves can be supplied. Cast Steel Valves with ends for welding can be supplied.

JENKINS BROS., 80 WHITE STREET, NEW YORK, N. Y.

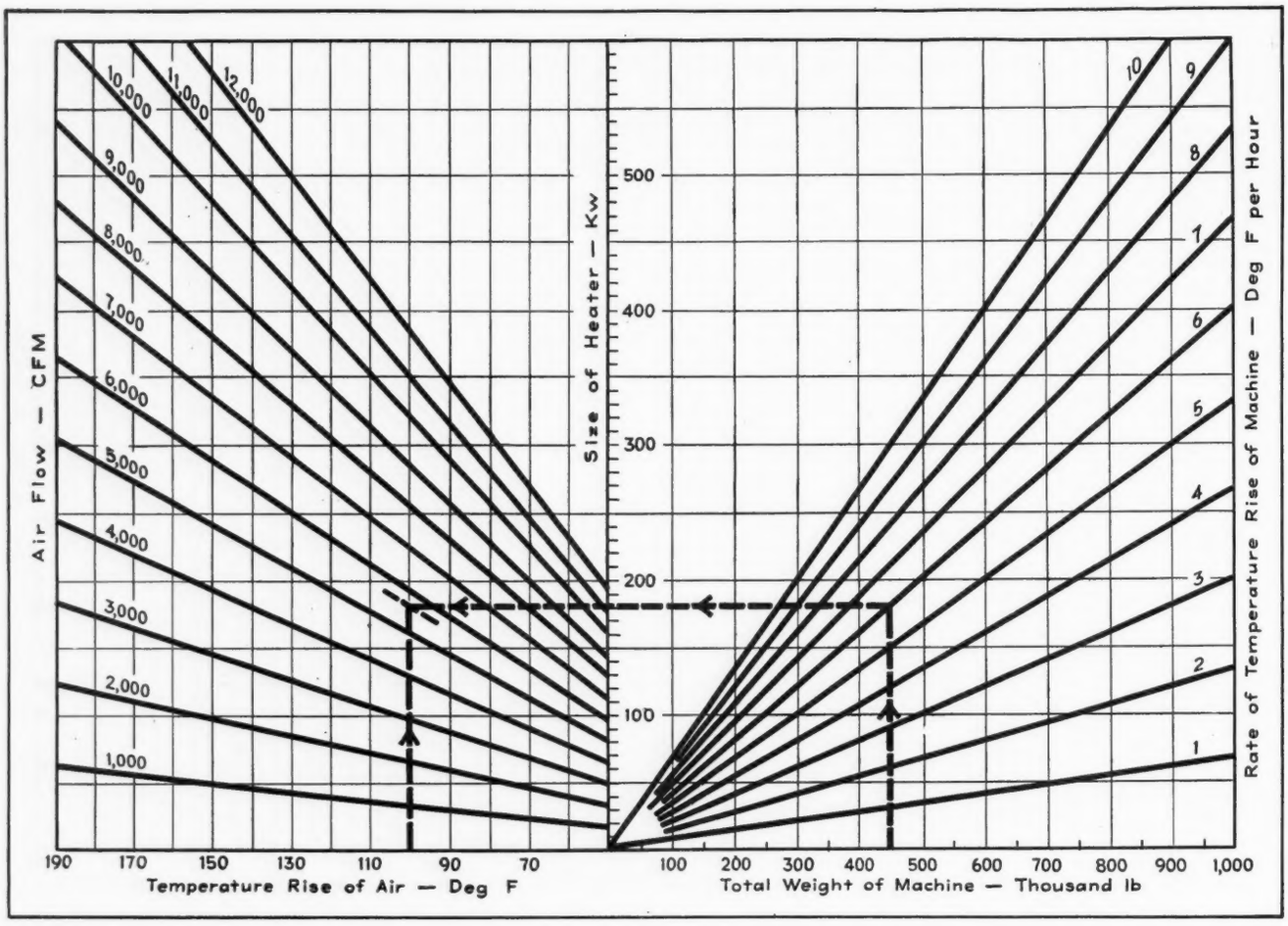
Bridgeport • Boston • Chicago — Philadelphia • Atlanta • Houston

TRADE JENKINS MARK Jenkins Bros.

#16 OF A SERIES designed to help in your selection of JENKINS VALVES

Number 92

Drying-Out Chart



ONE WAY OF DRYING OUT flooded electrical machinery is by building an enclosure through which hot air is forced by a fan. An electric heater can be quickly fashioned of ½x⅛-in. band iron, which has a resistance of about 0.009 ohms per foot when hot.

Chart gives size of heater required in kw for a given weight of machine and a desired rate of temperature rise. For weight of machine use total of iron and copper, as some safety factor is included in chart values. Bring large machines up to temperature slowly; over 10 F per hour is not recommended.

Example shows that a 450,000-lb generator can be brought up 6 F per hr with 180 kw. If air rise of 100 F over room temperature will be safe for insulation, a 5600-cfm fan is needed.

Temperature of delivered air should not be more than about 20 F above rated maximum for the insulation, hot enough to offset heat losses but not enough to damage winding over long period. A 10% oversize fan with a damper arrangement provides temperature regulation for the heated air flow.

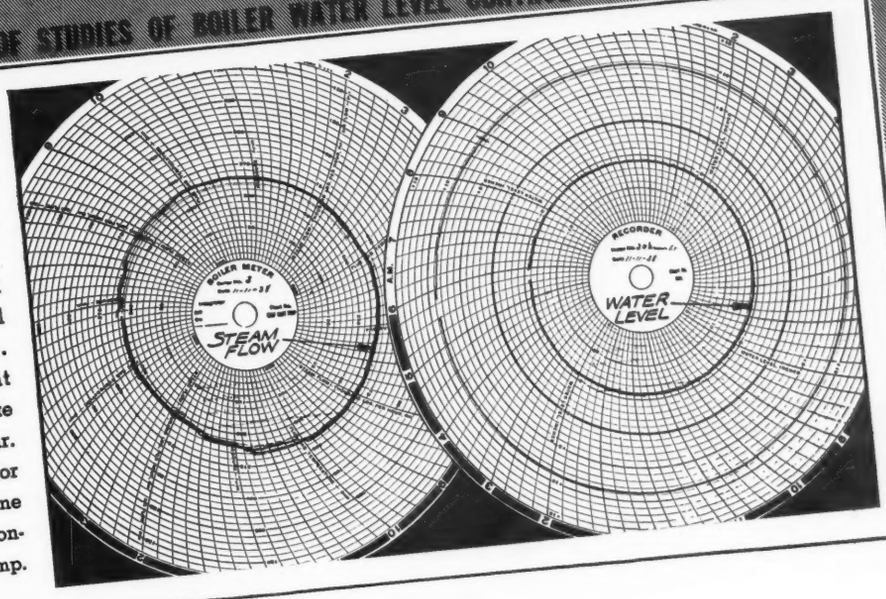
Preliminary to drying, it is a good idea to wash down windings with a cleaning solvent, wipe dry, remove tape at coil ends to let moisture out, and disconnect terminals. For large machines, insulate upper part of enclosure with rockwool and be sure heated air gets to base of machine. Check of coil temperature with indicator or thermocouple avoids insulation damage.

(Courtesy Hydro-Electric Power Commission of Ontario)

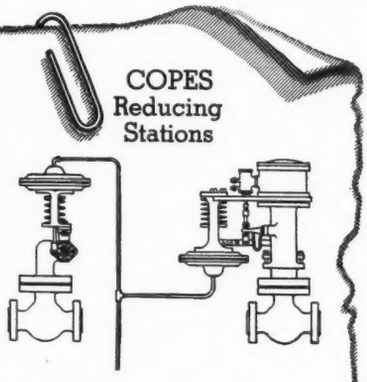
NO. 2 IN A SERIES OF STUDIES OF BOILER WATER LEVEL CONTROL WITH COPES FLOWMATIC

425 POUNDS W. S. P.

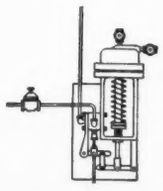
Gas-fired 425-lb. 725-deg. (ultimate operation at 860 lb., 830 deg.) B. & W. Integral Furnace Boiler tops original 400-lb. 600-deg. plant. Present loads constant at 65,000 lb. per hr. Ultimate peak, 200,000 lb. per hr. COPES Flowmatic Regulator holds water level within one inch. COPES governor controls the boiler feed pump.



★ Quickly, easily adjusted for any change in your plant conditions



Pressure reducing stations—built to the high COPES standards for accuracy and dependability—are suitable for every application. In this typical hook-up, a Master Control actuates a direct-operated valve and a relay-operated valve. Other possible hook-ups are unlimited. Write us about your pressure problems.



As accurate as your most sensitive instrument, as rugged as any equipment in your plant, the COPES Flowmatic compensates automatically for any temporary changes in your plant conditions. Not even a sudden change in drum pressure from any cause upsets the feed water flow or water level control. And if your conditions are permanently changed, it's a simple matter to adjust the COPES Flowmatic for the new conditions without calling on factory experts. Bulletin 417 tells how operators in one plant completely re-adjusted their Flowmatic in only 30 minutes without supervision. Write for this interesting bulletin.

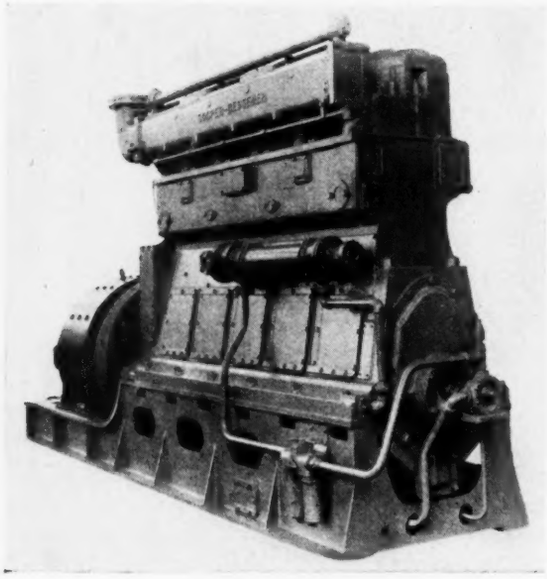
NORTHERN EQUIPMENT CO., 301 GROVE DRIVE, ERIE, PA.

Feed Water Regulators, Pump Governors, Differential Valves
Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS IN CANADA, ENGLAND, FRANCE, GERMANY AND ITALY
REPRESENTATIVES EVERYWHERE

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR

What's New In Plant Equipment



Diesel Engine

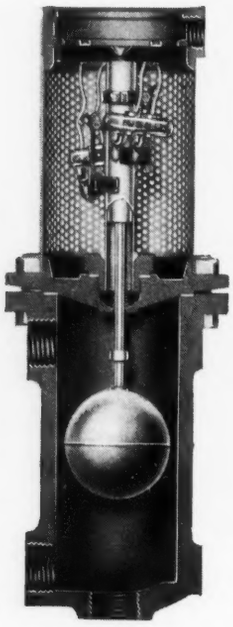
TYPE JS 4-cycle engine is made in 5-, 6-, 7- and 8-cyl units rated at 430, 525, 600 and 675 hp respectively at 400 rpm. Bore is 13 in, stroke 16 in. Crankshaft is 1-piece, 9-in. diameter steel forging. Main bearings are babbitt-lined steel shells with shim adjustment Eight piston rings are used, five compression and three for oil control, with one of the latter below the piston pin. Individual cylinder heads are bolted to cylinder-block top. Main valves seat directly in cylinder heads. Outside water jumpers transfer cooling water from cylinders to heads. Cooling-water header is cast integral with cylinder block, underneath air-intake header and on exhaust side of engine. Cooling water passes from cylinder heads by individual elbow connections to exhaust-manifold jacket. Fuel-injection system is patented Cooper-Bessemer atmospheric-relief type. Fuel injectors are mounted on camshaft housing cover and are gear driven from camshaft.

Cooper-Bessemer Corp, Mt Vernon, Ohio.

Insulation

FIREFOIL is insulating material with characteristics of structural material. Primarily used for bulkheads on ships, it is now said to be in use extensively as boiler casings, oven walls, linings for stacks, etc. It is made of alternate layers of flat and corrugated asbestos felt joined with new waterproof adhesive. Said to be vermin-proof and to have sufficient strength after soaking in water for 72 hours to withstand pressure of approximately 75 lb applied to one inch square die on surface.

Philip Carey Co, Lockland, Cincinnati, Ohio



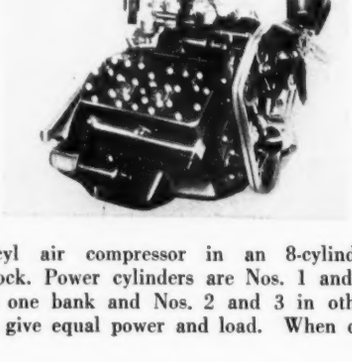
Liquid-Level Controller

MAGNETROL transmits float movement through magnetic force instead of rotary shaft or stuffing box. Provides 5-point control; pump regulation, low-water cutoff, low-water alarm, high-water alarm, and high-water cutoff. Is made in two models, for working pressures up to 550 lb. Special time-delay relay available to give proper control operation even under surging water level conditions.

Fred H Schaub Engrg Co, 325 West Huron St, Chicago, Ill.

Self-Propelled Air Compressor

ELIMINATING power take-offs, extra compressors, and trailers, power unit will replace standard Ford engine in truck. Combination engine and compressor can be operated by truck driver from cab. Supplies 55 cfm at 100-lb pressure, and is a standard full-sized Schramm air compressor adapted for installation in truck. Basically, unit is 4-cyl engine and

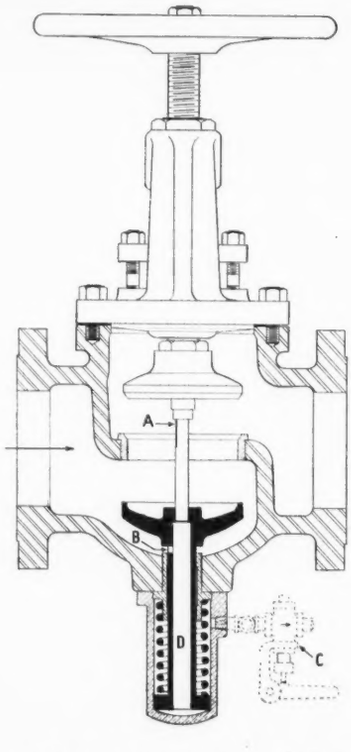


4-cyl air compressor in an 8-cylinder block. Power cylinders are Nos. 1 and 4 in one bank and Nos. 2 and 3 in other to give equal power and load. When operating as a truck, four power cylinders drive it through standard clutch, compressor cylinders being shut off so that no power is consumed or air compressed.

Schramm, Inc, 758 East Virginia Ave, West Chester, Pa.

Overspeed Valve

DU-AL combined stop and emergency valve provides manual control, emergency closure and automatic reopening for steam, air, gas or liquids. Wheel or manual side of valve is of conventional design, emergency valve being on the other end of the stem. Normally, emergency valve is held in full open position by spring shown in cylinder. Emergency valve disk with its extension and clearance piston comprise the one moving part. Clearance piston, which has no contact with cylinder, is surrounded by steam at air, gas or liquid line pressure. Steam passage is



shown from *B* through *D* in illustration. To close emergency valve, pilot valve *C* in line from underside of cylinder, or a similar valve at any one of desired remote-control points, is momentarily opened, thus releasing pressure element from cylinder in back of clearance piston. With full pressure remaining on front of piston, there is a net closing load of several hundred pounds, causing instant closure when pilot valve is opened. Main emergency valve closes in direction of flow and becomes unbalanced when seated. To reopen this valve, hand or manual valve is first closed. In that position,

THE CASE* OF THE GROWING CINDER PILE

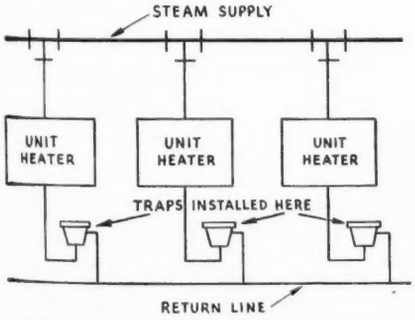
SOLVED WITH PREVENTIVE MAINTENANCE

"You'd think we were heating the whole outdoors," growled the BOSS, ". . . the way we burn coal around here."

"One of these days those boilers will bust," said the ENGINEER. "We've got to keep them at top speed all the time."

"Sounds like trouble," offered the CRANE REPRESENTATIVE, ". . . that Preventive Maintenance and the right Crane equipment should remedy."

AN old manufacturing plant was vacant for years. Then a machine tool company moved in. The building suited the tool builder well, but the cost of heating it was excessive. Two 125 h.p. boilers were used for heating—hooked up with a system of unit heaters. The boilers seemed to be bottomless as the coal pile vanished and the cinder pile grew higher.



There were plenty of heaters and they were big enough. Steam supply was adequate. Ordinary maintenance proved futile. It failed to disclose that the system was improperly drained—that condensate made it impossible for steam to get through the heaters. All heater outlets were piped to a common return.

Here's where Preventive Maintenance entered the picture. The Engineer was desperate. He called in J. M., the Crane Man. They found an accumulation of condensate in some of the heaters. And, as Preventive Maintenance counseled, for positive correction, they installed Crane inverted open float Steam Traps of the proper capacity on each of the unit heaters. See the sketch at left.

Results: (1) The problem was permanently solved. (2) Next winter coal consumption was cut from 13 to 8 cars, with a saving of almost double the cost of the Preventive Maintenance applied. (3) Another manufacturer has learned the sound economy of Preventive Maintenance, and of looking to the great Crane line for the right equipment for every flow control need; also, the wisdom of consulting the Crane Representative on every piping problem.

**This case is based on an actual experience of a Crane Representative in our Cincinnati Branch.*

CRANE STEAM TRAPS KEEP STEAM LINES HOT AND DRY

You are not getting the maximum heat and power from steam if your lines are not properly drained. You are straining the piping, shortening the life of valves, exposing steam operated equipment to serious damage when condensate is not removed.

In steam lines up to 600 pounds pressure, the wasteful and damaging effects of condensate are completely eliminated with Crane Inverted Open Float Steam Traps. These sturdy, simple, and low-cost traps will pay for themselves many times over. Once installed they require minimum attention—yet, automatically, stop steam waste, step up efficiency.

For pressures up to 200 pounds, the Crane line of No. 981 traps will give maximum protection against condensate troubles.

1940 our 85th YEAR

CRANE

CRANE CO., GENERAL OFFICES
836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

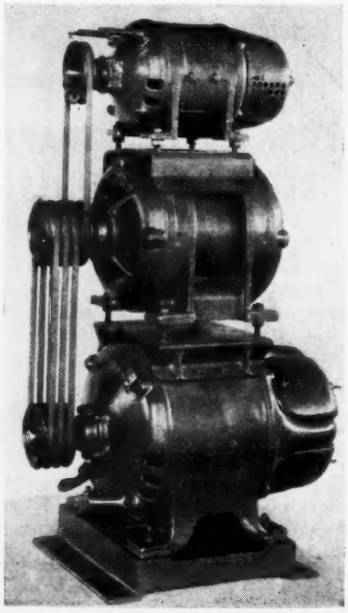
NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

recess in the guide stem *A* crosses the guide bushing in the emergency valve disk. This recess acts as a port, admitting line pressure from port *B* which immediately balances the pressure between the two seated valve disks and line pressure. The emergency valve then automatically returns to wide open position because of the spring shown, acting against piston.

Oscar H Ludeman, 420 Lexington Ave, New York, N. Y.

Pyramid-Mounted Motor-Generator Set

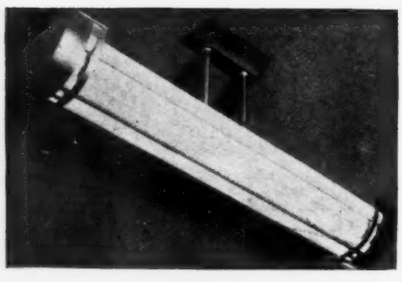
GENERATOR, motor and exciter, each self-contained unit, are assembled one above the other, thus requiring only floor space necessary for generator mounting. Generator is on top of induction motor, attached with base plate, and exciter is mounted in same way on motor. Generator and exciter are driven by V-belts from motor shaft, adjustment being by motor- and exciter-base-plates.



Allis-Chalmers Mfg Co, Milwaukee, Wis.

Fluorescent Unit

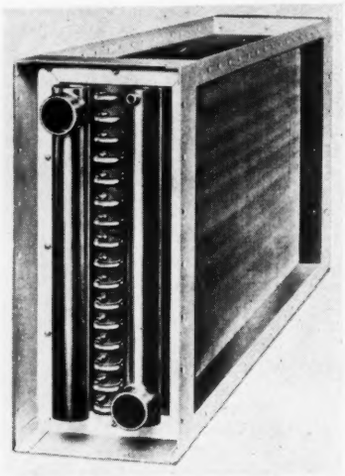
MIRALUME HF-200 comes complete with four 40-watt (48-in.) lamps, and all wiring and fittings. Unit is corrected for power factor and stroboscopic effect is practically eliminated, according to manufacturer. Choice of daylight or white lamps is available to users. Over-all length is 48½-in., width is 10½-in., and height is 7¾-in. Units are designed for 110-125 and 220-250 volts, and can be installed in any 60-cycle ac circuit.



Hygrade Sylvania Corp, Salem, Mass.

Cooling Surface

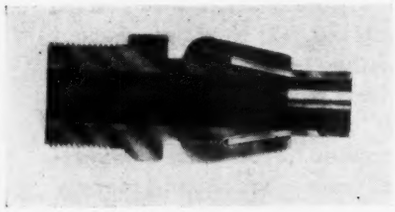
SERIES W (Water) surface is intended for air-cooling and cooling and dehumidifying with cold water, or for air heating, with hot water. Surface is fin-and-tube type that makes use of copper tubes and plate-type aluminum fins. Headers are of extruded copper tubing, with copper return bends. All joints are silver brazed, and close tube spacing yields ample prime surface.



John J Nesbitt, Inc, Philadelphia, Pa.

Connectors

SUPERSEAL connectors use exclusive compression joint, sealed both inside and outside with tubing ends flared to 20-deg angle. This provides a long flare with tubing wedged between self-aligning compression nut and fitting. Connectors can be loosened and tightened any number of times, still retaining full inside diameter of both tubing and fitting.

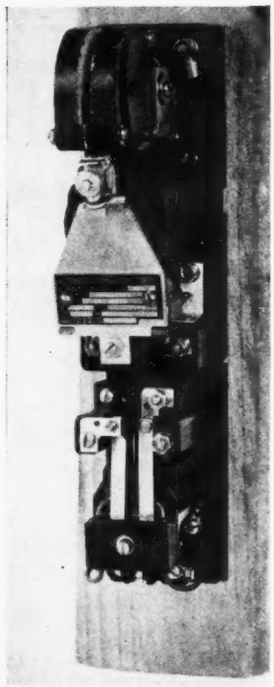


Superseal Co, 300 4th Ave, New York, N. Y.

Closing Relay

TYPE HKA pump-free control relay is designed for oil circuit breakers equipped with cut-off switches. Relay consists of two elements, operating and auxiliary. Former picks up and closes its main contacts for the closing solenoid and at the same time seals itself in. Auxiliary element is energized by solenoid cut-off switch closed by operation of solenoid mechanism. One set of contacts opens main-element coil circuit, thus deenergizing solenoid closing coil. Second set of contacts closes to seal in auxiliary element around cut-off switch so that, if control switch is held closed, there can be no further breaker closures until control switch contacts open to allow auxiliary element to reset.

General Electric Co, Schenectady, N. Y.



Anti-Vibration Unit

VIBRO-ISOLATOR consists of steel springs housed by special vertical channel irons with flat steel plates at the top and bottom. Pressed-steel cups hold springs in correct position. Adjustment bolt passes through leg or sub-base of machine to be isolated, fastening it securely to upper steel plate. This bolt then makes contact with tension plate resting on springs to hold machine and provide for alignment before and after installation. Alignment dowels project from tension plate and fit into clear holes in upper steel plate. Studs from upper steel plate pass through oversize holes in top flanges of side channels and are held in desired position by self-locking nuts. Contact between studs

MODERN POWER

for every service

THE BALDWIN GROUP

DE LA VERGNE ENGINE CO.

Subsidiary of THE BALDWIN LOCOMOTIVE WORKS

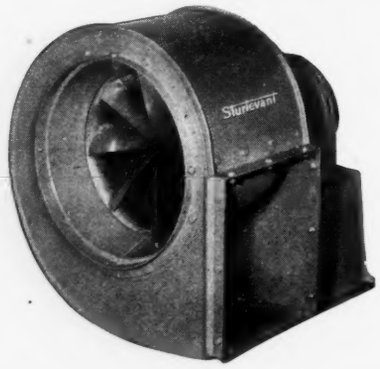
PHILADELPHIA

and side flange is eliminated by suitable isolating material. Holes are furnished in lower steel plate for anchoring entire unit to foundation.

Korfund Co, Inc, 48-15 32nd Pl, Long Island City, N. Y.

Ventilating Blower

REXVANE vent sets are centrifugal fans with direct-connected motor. Feature is radial-blade fan rotor said to permit higher rotative speeds, lower outlet velocities, and more dependable balance when handling air which contains grease or solid particles. Cone-shaped inlets guide entering air to rotor with minimum shock

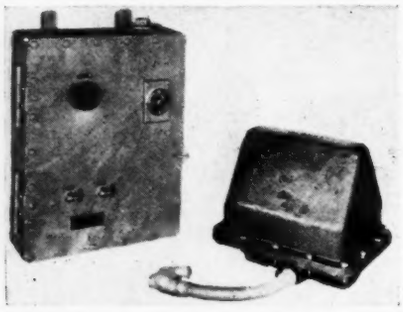


and turbulence. Rotor consists of eight blades, each of which is curved into inlet in direction of rotation. Curved portions of blade are banded together by a broad hoop which strengthens rotor and broadens path of entering air. Rotor is mounted directly on motor shaft.

B F Sturtevant Co, 47 Readville St, Hyde Park, Boston, Mass.

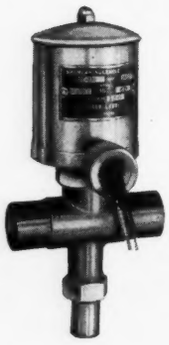
Vibrators

EXPLOSION-PROOF vibrators are addition to standard line, and are for use where the atmospheric conditions are dangerous. They are heavy, pulsating electro-magnets fully encased in thick, electric-furnace steel case, with ground joints and armored cable lead. Remote electric control panel containing rectifier operating



switches and rheostat for controlling vibrator is also fully enclosed in cast-iron case, with ground joints and approved explosion-proof fittings. For attachment to bins, chutes, hoppers, etc, to prevent arching over and hanging-up of material.

Syntron Co, 492 Lexington Ave, Homer City, Pa.



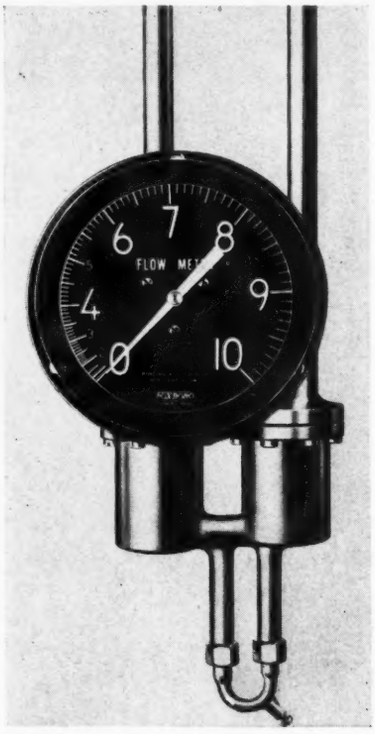
Solenoid Valve

SPORLAN valves for water and refrigerants can be taken apart in field for servicing or repairing. Possibility of refrigerant leaks has been minimized by welding rather than soldering enclosing tube. Coils are moisture proof, valves are said to be very easily opened against rated pressures.

Spoehrer-Lange Co, St. Louis, Mo.

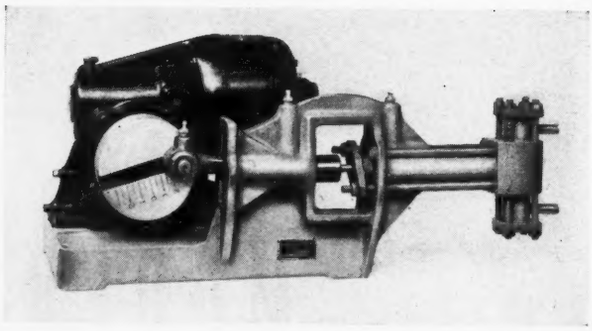
Indicating Flow Meter

DIAL-TYPE meter has extra large movement designed to reduce lost motion. Wide-spaced bearings are said to insure perfect alignment of moving parts, and direct driving action makes calibration accurate and permanent. Patented check floats said to prevent loss of mercury from over range, reverse flow or faulty opera-



tion of valves. Emulsification of mercury eliminated also, because check valves prevent oil from blowing through. These valves are located so that they are always immersed in mercury and are always protected against corrosion, moisture or dirt.

Foxboro Co, 38 Neponset Ave, Foxboro, Mass.



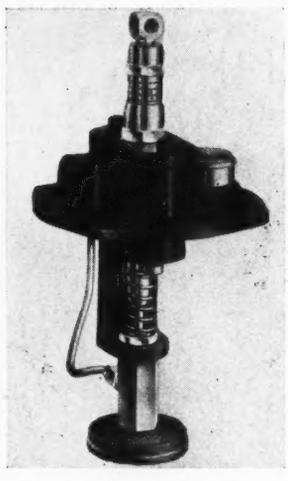
Hypochlorite Pump

DESIGNED specially for small water supplies, pumps have sufficient capacity for chlorination of water supplies from 100 to 100,000 gpd. With maximum pressure limit of 100 lb, manufacturer says that they will pump against any head encountered in service for which they are built. Supplied in corrosion-resistant metals to withstand action of hypochlorite. Column valve is designed to discharge air and small particles of dirt to prevent air binding or clogging. Pumps have capacity of from 1 to 10 gph.

Milton Roy, 3160 Kensington Ave, Philadelphia, Pa.

Hydraulic Lubricator

BIJUR automatic lubricators have no mechanical drive connection between machine and lubricator pump. In place of the drive mechanism a small tube is connected between machine hydraulic system and pump used for feeding oil to various bearings. Lubricator pump is so arranged that inlet is submerged under oil in reservoir. This inlet is protected by felt filter disk. At the unit end opposite to lubricator cylinder and in direct line with it is hydraulic operating cylinder. Two pistons (lubricator and hydraulic) are connected



by a common piston rod, ball-jointed to each. Compression spring surrounding the piston rod tends to force the latter towards hydraulic cylinder. Thus, during low-pressure period of hydraulic cycle, complete piston-rod assembly moves under spring action to one end of stroke, draw-

(*Continued on page* 128)

Water Velocity?
Condenser Design?
Temperature?
Water Conditions?
Presence of Air?

Which condenser tube alloy is best for *your* combination of these variables?

THERE is such a complication of operating factors having an influence on the service life of condenser tubes that no one tube alloy can possibly solve all problems.

To determine the tube alloy that will give the greatest service per dollar of cost requires metallurgical experience and practical knowledge of specific operating conditions. So we suggest that you take advantage of the experience of our Technical and Engineering Departments. They can place before you performance records of copper alloys under operating conditions similar to your problem. No charge is made for such consultation. 39122

The following are the nominal compositions of Anaconda condenser tubes:

Alloy	Cu%	Ni%	Zn%	Al%	Sn%	As%
Super-Nickel 701	70	30	—	—	—	—
Cupro Nickel 712	80	20	—	—	—	—
Ambrac* 850	75	20	5	—	—	—
Ambraloy* 901	95	—	—	5	—	—
Ambraloy* 927 (Pat.)	76	—	21.95	2	—	0.05
Admiralty Alloy 442	70	—	29	—	1	—
Arsenical Admiralty 439	70	—	28.95	—	1	0.05
Red Brass 85%	85	—	15	—	—	—
Tobin Bronze* 452	60	—	39.25	—	0.75	—
Muntz Metal 65	60	—	40	—	—	—
Copper, Arsenical Deoxidized 108	99.63	—	(Phosphorus 0.02%)	—	—	0.35

*Trade-marks Reg. U. S. Pat. Off.

ANACONDA from mine to consumer

Anaconda Condenser Tubes

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

In Canada: Anaconda American Brass Ltd., New Toronto, Ont. Subsidiary of Anaconda Copper Mining Company

Bend, Don't Break . . .

"WHEN A STORM comes along, it flattens ripe wheat because it's dry and can't bend with the wind," explained Grandma Fontaine to Scarlett, in *Gone With the Wind*. "But ripe buckwheat's got sap in it and it bends. And when the wind has passed, it springs up almost as straight and strong as before."

Now Grandma wasn't turning farmer; she was just using buckwheat to give Scarlett an object lesson. She meant that the *limber* man can take a beating in an argument and still keep his spirit, but the bullheaded fellow who won't yield an inch ends up by getting his spirit broken. Grandma was just making sure that Scarlett understood that, after all, the only thing that matters in the long run is the *end* to be attained. The *way* of attaining it isn't important.

That's the hard thing for most of us to stomach. To get a certain result—in business, life or politics—we figure out a certain method. First thing we know, we're so convinced that *our method* is right that we begin to feel that anybody who doesn't agree with us is a fool. The *way* of doing the thing has become more important to us than the *result*. Like the bullheaded salesman, we win the argument, but lose the business.

Sometimes, it's right to say with General Grant, "I'll fight it out on this line if it takes all summer." But be sure when you say it that that's the only thing left to do. Otherwise, a compromise with the other side gains you at least part of what you're after, a more advanced place to start out from when you go after the rest. It gives you a chance to get your wind, to get new plans worked out, so you can spring up again like the buckwheat when the time comes.

There's an old Negro story that makes my point. A reporter was congratulating old Mose on living to be a hundred and seven. "To what do you attribute your long life?" he asked.

"To cooperation, Boss," said Mose.

"What do you mean, cooperation?" asked the reporter.

"Well," said Mose, "Hit's like disyere. Our ole parson done tole me, a long time ago, dat some things am inevitable—cain't whup 'em nohow. So, since den, when de inevitable comes along, I jus' slacks off—for de time bein'—and cooperates wid it!"

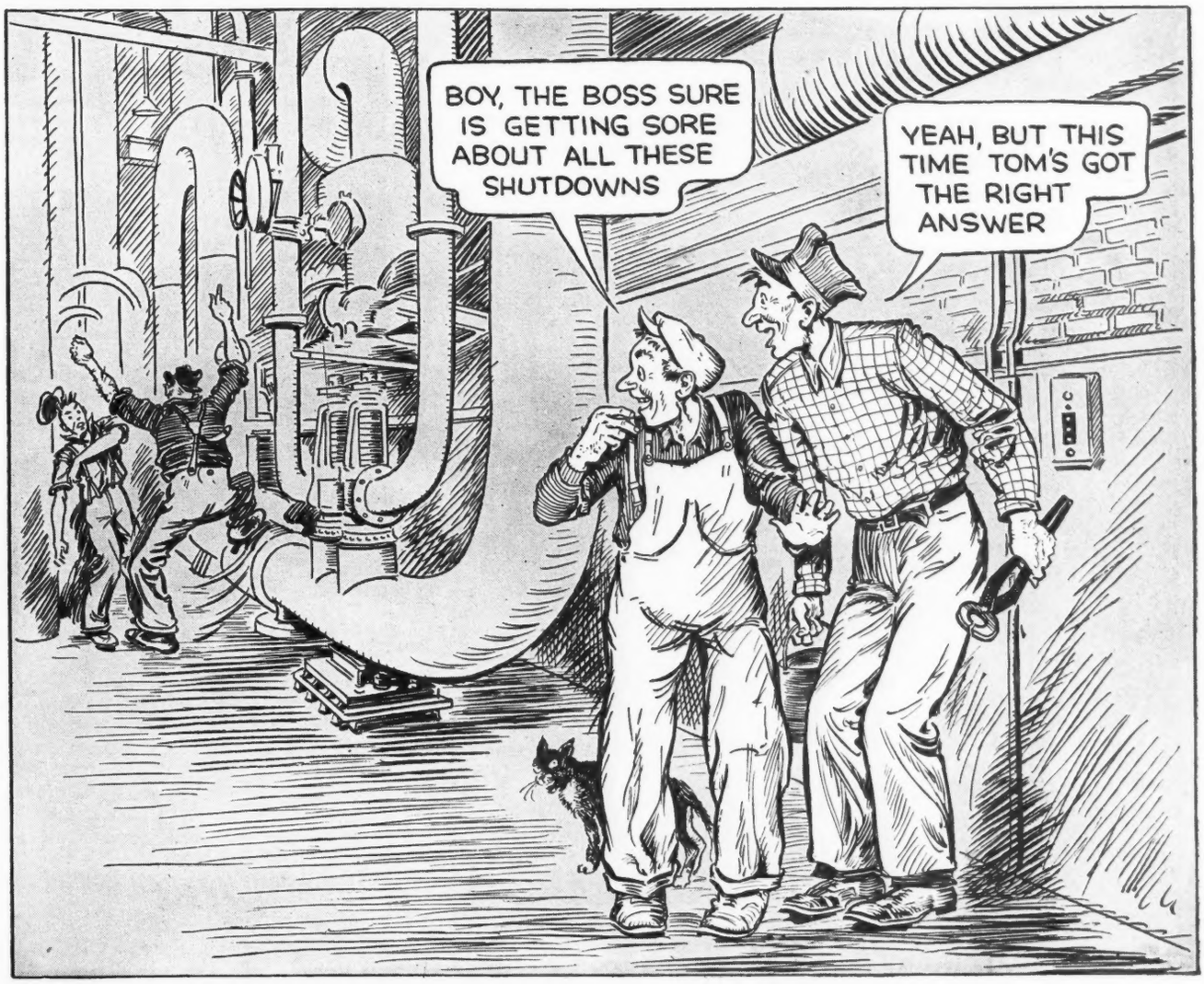
George Edwards

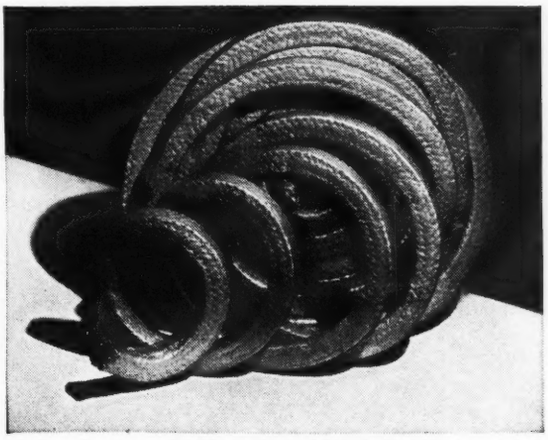
Engineer

The Scotsman's Prayer: "God grant I may be right—'cause He knows I never change my mind!"—EDMUND BRUNNER

KEEPING 'EM ROLLING

By WESTCOTT





J-M INTERLOCKED: This packing is the latest development of the J-M Packing laboratory. Strands of asbestos yarn are tightly interlocked to form a solid, square braid that cannot ravel or come apart.

JOHNS-MANVILLE JM PRODUCTS **Johns-Manville**

PACKINGS & GASKETS

TOM'S ANSWER...*Buy J-M Interlocked Packing and Reduce Shutdowns*

EVERY time you replace a packing, you lose far more than the bare material costs. Time, labor and general shutdown charges make up your real expenses. And those are the costs you reduce with J-M Interlocked. This new-type J-M Packing represents the greatest single improvement ever made in braided packing. It's braided solid . . . has no layers to wear through . . . cannot come apart or ravel. It gives the longer, more efficient service that's typical of the complete J-M line.

For details on Interlocked and other money-saving J-M Packings and Gaskets, send for the new J-M Packing Catalog. Johns-Manville, 22 East 40th Street, New York, N. Y.

THERE'S A DISTRIBUTOR NEAR YOU

Everything has been narrowed down to its simplest form. All the material about any given packing is grouped on one page — service qualifications are clearly indicated — unique layout arrangement instantly spotlights packing construction.

There are other features too in this latest Belmont Catalog. Send for your copy today. It's an invaluable reference book wherever packings are used.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

BELMONT

PACKINGS

THE BELMONT PACKING & RUBBER COMPANY

BUTLER AND SEPVIVA STREETS • PHILADELPHIA, PA.

New Equipment

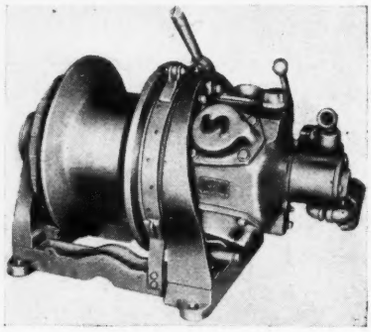
(Continued from page 124)

ing a definite amount of oil into lubricating cylinder. Then, at high-pressure period, assembly is forced to other end of the stroke, discharging oil to oil-distribution system.

Bijur Lubricating Corp, Long Island City, N. Y.

Single-Drum Hoist

CLASS L-111 reversible Pistonair hoist is designed for both surface and underground operation, and is fitted with Lubriseal ball bearings. Comes with large drums and 4-cyl reciprocating air motor.



Furnished with either positive or friction-type clutch and is available fully enclosed for protection against dust and dirt.

Sullivan Machinery Co, Michigan City, Ind.

Test Lamp

SG-100 test lamp requires no fuses for safety, has only one test lead, two parts to handle, and is easily replaced. Can be used on ac or dc circuits from 110 to 600 volts, and is equipped with resistor which limits current to such low value that there is no tripping of relays when checking control panels. Large test prod holder contains a 500-ohm, 20-watt resistor of Nichrome wire wound on vitreous enamel core, and unit also includes lamp socket, filament lamp, and magnifying bulls-eye. Lamp socket is wired above resistor, with single test lead wired to side of lamp socket. Resistor and lamp filament are wired in series between test prods, eliminating shorting of resistor.

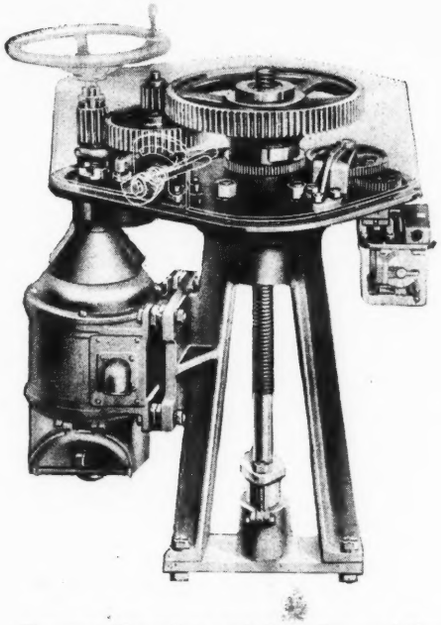
The Sittler Co, 1133 West Van Buren St, Chicago, Ill.

Odor Adsorber

IMPROVED portable model of adsorber uses principle of ordinary gas mask, that is, positive extraction principle of air-odor removal. Unit uses adsorption medium composed of granular cocoanut-shell carbon. Has one moving part—the electric

MOTORIZED VALVE CONTROL
For the Modern Power Plant

Part of a Single Order for 141 Chapman Motor Units



Chapman Motor Unit with Cover Removed Showing Simplicity and Small Number of Parts.

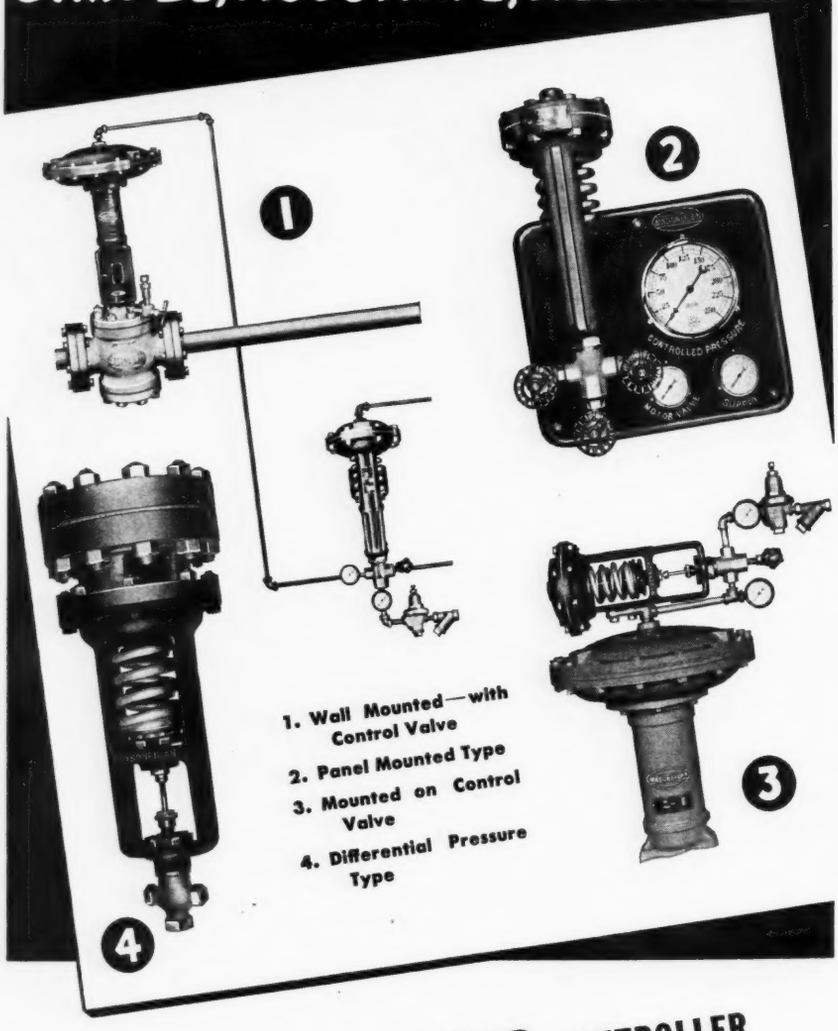
Chapman
Motor Units

The high pressures and temperatures of modern steam practice make motor-operated valves essential for adequate control. Chapman Motor Units are designed and built to provide positive, dependable control under the most exacting service conditions. The unit is extremely rugged and simple, with many unique features, all time-tested in actual service. One outstanding feature, especially important in the power field, is the micrometer-adjusted limit switch which controls seating to any predetermined tightness, and elimiates all possibility of *jamming*. The widespread use of Chapman Motor Units, and reorders for extensions and new plants, are good evidence of the quality of service these units are rendering in all fields of application.

Write for Bulletin describing the Chapman Motor Unit.

THE CHAPMAN VALVE
MANUFACTURING COMPANY
INDIAN ORCHARD, MASS.

SIMPLE, ACCURATE, RELIABLE



THE SYNCROMASTER CONTROLLER CUTS OPERATING AND MAINTENANCE COSTS

Simplicity of design, construction, installation and operation are features of the hydraulic operated Syncromaster Pressure Controller. In spite of the use of highest quality materials and workmanship, therefore, pressure control with this equipment is less costly than with other less advanced types. Because the Syncromaster Pressure Controller is:

less expensive to buy—simplification means lower manufacturing costs, a saving passed on to you.

less expensive to install—no chains, weights, levers, complicated hook-ups etc., permitting easy and quick installation.

less expensive to operate—operation from any external water supply of 20 to 150 lbs. pressure, with a *minimum* water consumption. Operation is fully automatic, sensitive and full throttling.

less expensive to maintain—low maintenance costs; rugged construction insures long life and reliable service.

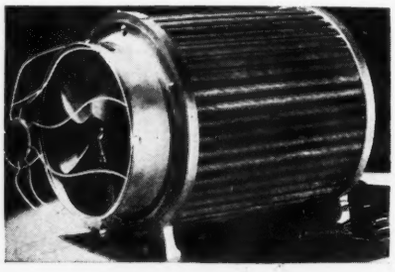
If your problem is reliable pressure control for primary or auxiliary steam lines, desuperheating service, pumps, make-up systems, heating and evaporating service or any service where accurate, positive control is required, investigate this simplified equipment.

Write for Catalog

MASON-NEILAN REGULATOR CO.
1186 ADAMS ST., BOSTON, MASS.
NEW YORK BUFFALO PHILADELPHIA CHICAGO TULSA
PITTSBURGH ST. LOUIS TOLEDO HOUSTON LOS ANGELES
MASON REGULATOR CO., OF CANADA, LTD., MONTREAL, CANADA

MASONEILAN

motor which draws foul air in and delivers purified air back into room. Adsorbent carbon is said to hold more than

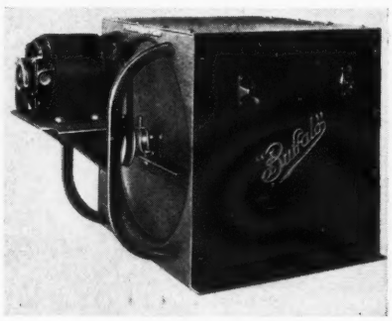


20% of its own weight in odors, and under normal conditions will keep high efficiency for several years, after which it may be replaced.

Dorex Air Conditioning Div, 116A E 32nd St, New York, N. Y.

Fans

BUFFALO L BREEZO is for application where propeller type fan is needed, but where motor must be out of air stream. Motor, V-belt, pulleys and one bearing are entirely outside of path of air being handled. Units designed to operate against

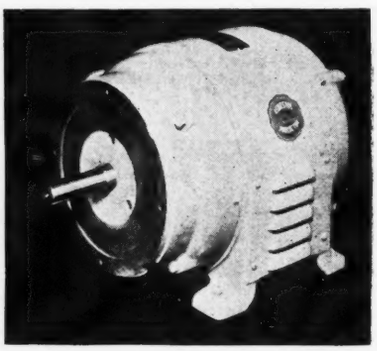


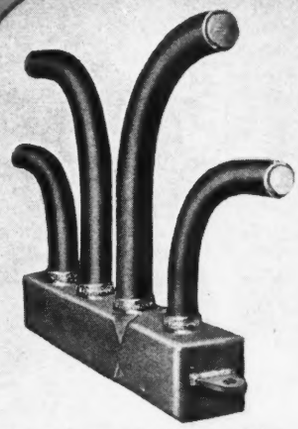
a head as high as 1½-in static pressure. Housings are so made that air inlet may be at the top, bottom, or either side of the unit and may be changed from one to another if necessary. Standard arrangement is bottom inlet.

Buffalo Forge Co, 488 Broadway, Buffalo, N. Y.

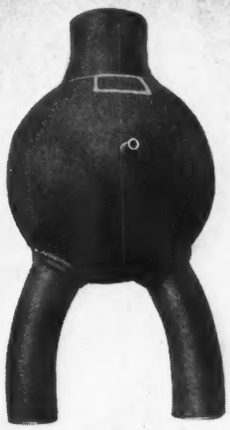
Motor Shields

UNIMOUNT END SHIELDS have flat surface to facilitate mounting of pumps and other direct-driven equipment, and are available with all U. S. Electrical motors. Can be

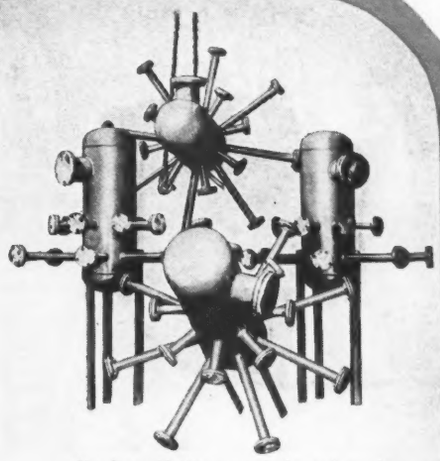




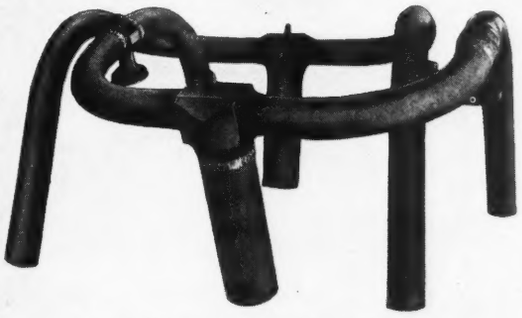
Main Boiler Feed for 2000 lb.—320° F



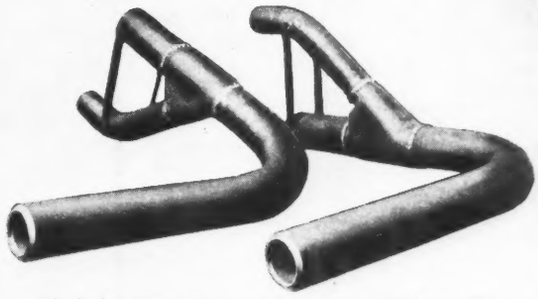
Spherical Steam Header for 1250 lb.—925° F



Headers with 17 accurately located nozzles—"Masterwelded"

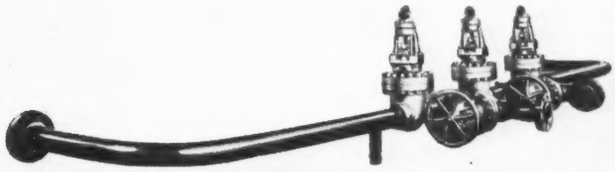


Prefabricated pipe assemblies for 1350 lb.—950° F



8" boiler leads—with 6" by pass connections—1750 lb.—450° F

Corrugated and Corruturn Bends, Carbon Steel



6" Steam Header for 725 lb.—825° F

THEY MAY LOOK FUNNY BUT— THEY'LL ALL DO A REAL JOB

These strange shaped, odd looking examples of Kellogg prefabrication skill illustrated above were each fabricated to overcome some difficult and specific piping problem.

By completing as many of the fabricating operations as possible in the Kellogg plant, field welding is reduced to a minimum.

Consult a Kellogg engineer on all piping problems involving intricate design, high pressures and high temperatures.

KELLOGG

THE M. W. KELLOGG COMPANY

JERSEY CITY · NEW JERSEY · 225 B'WAY, N. Y.

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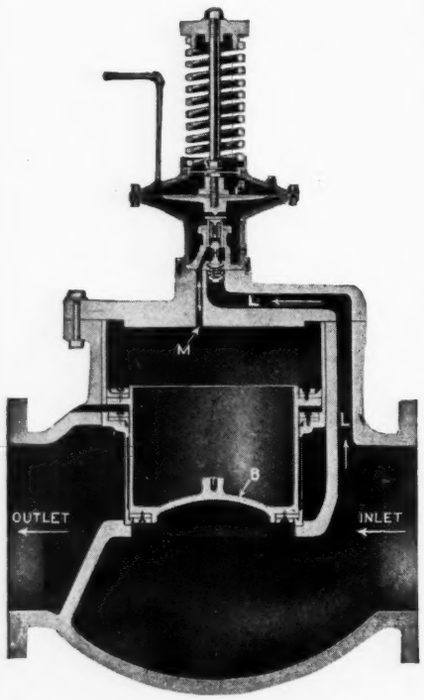
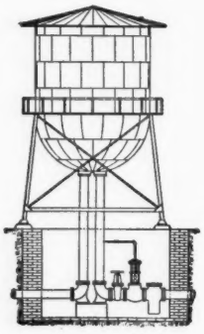
CHICAGO: 122 SOUTH MICHIGAN AVENUE

LOS ANGELES: 609 SOUTH GRAND · TULSA: PHILTOWER BLDG

"Masterflex" Prefabricated Piping Systems · "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic Cracking Units. Thermal and Catalytic Polymerization Units · JUIK Processes for Lubricating Oil Plants. Plastic Refractories · Radial Brick Chimneys.

Golden Anderson
SPECIALTY
VALVES





ALTITUDE CONTROL

• No tank or standpipe can overflow if equipped with a G-A Altitude Control Valve. Maintains automatic water level at all time. Positive in action. Air and water cushioned. Full bronze trim with no metal contacts. No water hammer or shock. Sizes 2" to 36" in angle or globe patterns. Write for illustrated catalog for full details on the complete G-A line.

For more complete details of the entire G-A line, write for free catalog today.

also

Triple Acting Non-Return . . . Pressure Reducing . . . Altitude Control . . . Float Control . . . Check Valves, etc.

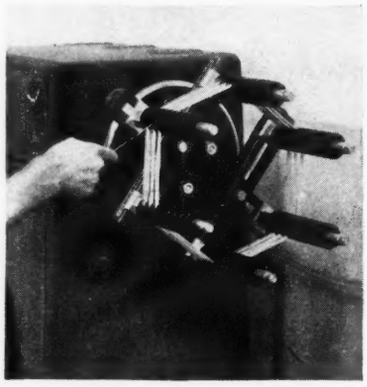
GOLDEN-ANDERSON VALVE SPECIALTY CO.
FULTON BLDG. PITTSBURGH, PA.

assembled on either end of motor, and used to mount footless motor to a machine frame. Unimount shields said to eliminate necessity for adapter, save mounting time and conserve space.

U. S. Electrical Motors, Inc., 200 E Slauson Ave., Los Angeles, Calif.

Coil Winder Drive

IDEAL coil-winder drives have variable-speed transmission, sealed ball bearings, V-belt drive without gears. Starting and stopping, as well as setting, entirely controlled by operator through foot movement. Infinite number of driving speeds



available, together with brake, which goes into operation when operator removes foot from pedal. Handwheel mounted on shaft provides a means of hand-turning coils. Revolution counter records by addition or subtraction, and machine comes equipped with pilot light.

Ideal Commutator Dresser Co, 1025 Park Ave, Sycamore, Ill.

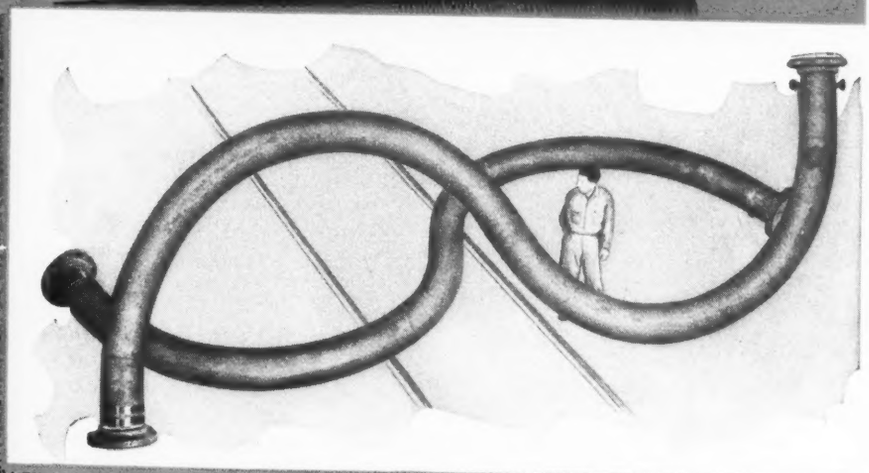
Steam Traps

ADDITION to line of steam traps includes No. 20, designed along the line of previous models, with several improvements. These include lever mechanism of new design

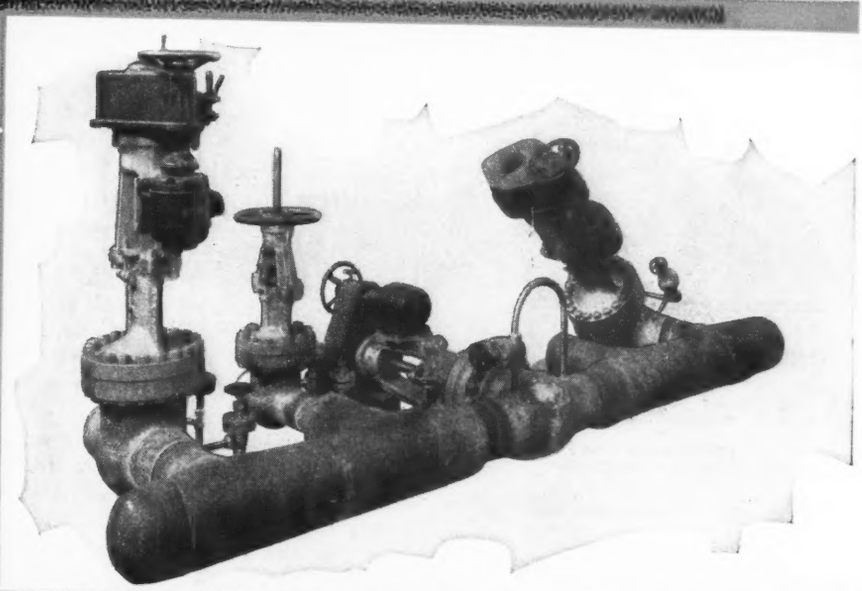
with no pins or pivots, a drain plug at the bottom, and higher operating pressures. Old traps worked under 150-lb pressures; new ones have capacity up to 200 lb.

V D Anderson Co, 1934 W 96th St, Cleveland, Ohio

MIDWEST *Alloy* PIPING



14" O.D. Chromium-Molybdenum pipe bends with Van Stone laps. Entire bends annealed after fabrication.



Carbon-Molybdenum header stress relieved in furnace before welding on valves which were welded by preheating and stress relieving with induction method.

PRESSURE piping users have found that alloy tubing presents many problems and difficulties not encountered when low carbon steel materials are used. Some have learned by bitter experience that the utmost care must be exercised in selecting a fabricator . . . one who has wide experience in the special manufacturing procedures required by the various alloys. It is also essential that the fabricator's welders be skilled on welding alloy tubing . . . and that he have the heat treating furnaces and other special equipment needed.

Each of the three Midwest plants is thoroughly familiar with all the "do's" and "don'ts" peculiar to the fabrication of alloy tubing. Midwest has welders qualified on the alloys . . . and Midwest has the special equipment so essential to the successful fabrication of alloy tubing.

Whenever you need alloy piping, you will find it definitely advantageous to get in touch with the nearest Midwest office.

MIDWEST PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 S. Second Street, St. Louis, Mo.

Plants: St. Louis, Passaic (N. J.) and Los Angeles · *Sales Offices:* Chicago—946 Marquette Building · Houston—1716 Second National Bank Building · Los Angeles—520 Anderson Street · New York—(Eastern Division) 30 Church Street · Tulsa—533 Mayo Building.

ADVERTISING PAGES REMOVED

This ROTO Feature Earns Big Money for Power Plants

Model 135 Air-driven Motor with self-feeding cage-type head, and air valve for one-man operation.

WITH the Rapid Action Roto Tube Cleaner, one man cleans more tubes per hour than a team of men using the old type tube cleaner. An air valve directly behind the motor gives the operator full control of the cleaner. He can turn the air on and off instantly, without signalling delays, and the accumulated time saved between each tube cleaned makes it possible to put the boiler back on the line earning money hours faster.

The powerful new Roto motor, the rugged self-feeding cage and swing frame heads, universal joints and drills, and the exclusive Roto air valve provide a tube cleaning combination that is setting new performance records in every power plant where it is used.

Now, more than ever before, it will pay you to clean tubes more frequently. We'd like to prove it in your plant.

Other ROTO Features

- ★ make better use of air consumed, without back pressure;
- ★ develop unbelievable speed and power, through new design;
- ★ self-feeding cage and swing-frame heads, universal joints and drills have what it takes to do a real job;
- ★ available for straight and curved tubes ½" to 12" I.D.

See Our Adv. in Sweet's and Write

THE ROTO COMPANY

145 Sussex Ave. Newark, N. J.

Watch for these "handbook" articles

1. Alternating-current motors—April.
2. Diesel data—200 plants—June.
3. Engineering data on 400 modern steam and hydroelectric plants—September.
4. Principles and practice of combustion—December.

It Pays You to Read POWER Regularly

New Bulletins

BOILERS AND ACCESSORIES

1 REFRACTORY CEMENT—Babcock & Wilcox Co, 85 Liberty St, New York, N. Y. Bulletin R-19 describes B & W insulating concrete mix, used to form rammed monolithic or cast shapes, simply by adding water.

2 EXPANDERS—Gustav Weideke Co, Dayton, Ohio. Revised page No. 61, 1940 issue, is designed for insertion in Ideal catalog 57, and covers Ideal adjustable condenser-tube-expanders, made with tapered rollers.

3 COAL—Chesapeake & Ohio Lines, Coal Traffic Dept, Cleveland, Ohio. 24-page booklet, "The Coal Bin of America," presents the story of coal from the beginning, starting with its formation and following through, showing its uses and effects it has had upon man and industry. Describes C & O service for handling coal from mine to power plant.

4 CONDENSATE RETURN — Roots-Connersville Blower Corp, Connersville, Ind. Bulletin 260-B14C, with price list Form L14E, covers complete line of automatic condensate-return units for vented gravity systems.

5 STOKER—Iron Fireman Mfg Co, 3295 W 106th St, Cleveland, Ohio. Catalog 7060 describes Iron Fireman pneumatic spreader stoker, with operating details, installations, diagrams, and specifications.

6 FURNACES—Babcock & Wilcox Co, 85 Liberty St, New York, N. Y. 32-page bulletin G-16 discusses water cooling for boiler furnaces, describes and illustrates details of B & W water-cooled furnace constructions.

7 INSULATION PRODUCTS—Philip Carey Co, Lockland, Ohio. "Proved Protection Against Wasted Profits" suggests points to check for profit-leaks, and gives descriptions of Carey products which help stop those leaks.

8 BAROMETRIC CONDENSERS — Ingersoll-Rand Co, 11 Broadway, New York, N. Y. 20-page bulletin No. 9424 covers disk-flow, counter-current-type barometric condensers. Contains in addition to description and advantages, diagrams showing operation, specifications and suggested arrangements.

ELECTRICAL EQUIPMENT

9 SWITCHBOARD INSTRUMENTS—General Electric Co, Schenectady, N. Y. Complete line of rectangular switchboard instruments is described in GEA-1758B. These include ac ammeters, voltmeters, wattmeters, power-factor meters, frequency meters, dc ammeters, and voltmeters.

10 TRANSFORMERS — Allis-Chalmers Mfg Co, Milwaukee, Wis. Bulletin B6043 covers Chlorextol-filled transformers. Outlines savings that can be obtained by this type transformer, and lists several advantages of the type.

11 CAPACITORS—General Electric Co, Schenectady, N. Y. "Power Factor and its Improvement" is subject of GEA-3225. Gives definition of power factor and tells what capacitors can do to improve it.

12 ELECTRICAL EQUIPMENT — Westinghouse Electric & Mfg Co, East Pittsburgh, Pa. 50-page "Quick Selector" catalog No. 30-000 is designed to help user of electrical apparatus select right equipment for motor or lighting circuit. Includes safety switches, circuit breakers, multibreakers, motor-control devices, etc.

13 CIRCUIT BREAKERS—ITE Circuit Breaker Co, 19th & Hamilton Sts, Philadelphia, Pa. 16-page illustrated booklet 3906 describes Type LG Circuit breakers, covering engineering features developed in circuit breaker industry, such as laminated bridges, arcing, contact, blow-on principles, etc.

HEATING, AIR CONDITIONING AND REFRIGERATION

14 VENTILATING SETS—De Bothezat Ventilating Equipment Div, American Machine & Metals Inc, East Moline, Ill. 24-page booklet describes Axial-Flow ventilating sets, volume and pressure types. Booklet includes charts showing friction and duct sizing for round and rectangular ducts.

New, Easy Way to Replace Gaskets!

FLANGE-JACKS

PATENT PENDING

Here's How Flange-Jacks Work:
Remove opposite flange bolts, insert jaws of Flange-Jacks in holes and tighten. After removing other bolts, tighten down jackscrews together, separating flanges evenly until opening is large enough to remove old gasket and insert new one.

NO HAMMERS, NO CHISELS, NO WEDGES

No Broken Flanges • No Damaged Faces • No Pipe Vibration • No Dangerous Sparks • No Long Shut-downs

You can replace gaskets in flanged pipe lines easier, quicker and safer than ever before by using Flange-Jacks—a new tool now introduced by Garlock.

That difficult job becomes a most simple operation when you let Flange-Jacks do the work. Even if a joint is located where working space is cramped—making it hard to use hammers and chisels—Flange-Jacks will open it easily. Send coupon below for folder.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK

Manufacturers of Mechanical Packings and Gaskets Since 1887

THE GARLOCK PACKING COMPANY, Palmyra, N. Y.
Please send descriptive folder on Flange-Jacks.

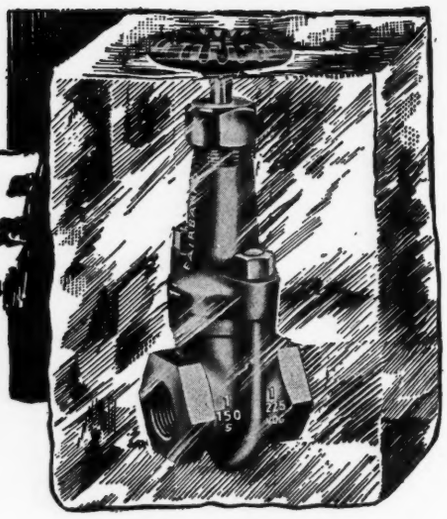
Name.....

Company.....

Address.....

POW. 3-40

Cannot FREEZE *or* CLOG



Relief slots on the threaded bonnet bushing of Fairbanks U-Bolt Gate Valves insure drainage back into the body chamber. This eliminates freezing, clogging and excessive stem thread wear.

This and the following make the Fairbanks better "service" valves.

Extra deep stuffing box, with follower gland and compression packing, insures a tight spindle joint. Back seat is above stem threads for repacking when wide open under pressure. Sediment cannot reach it. Male and female body and bonnet joint, fitted with high-pressure steam gasket, make a tight leak-proof fit.

Large diameter bronze spindle, with more than five threads in contact with bonnet bushing. Reversible double-taper horse-shoe type knife-edge wedge for cutting through heavy viscous fluids. Bronze seats carefully gauged for tight fit with wedge. Body and bonnet made of Fairbanks Semi-Steel, having an average tensile strength of 40,000 lbs. per sq. in.

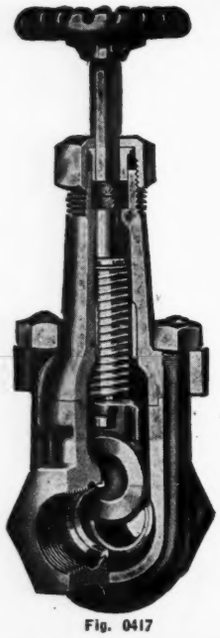


Fig. 0417

The All-Iron pattern has a steel spindle and iron packing nut, follower gland and wedge. Seats are integral with the body, accurately machined for tightness.

When a husky, inexpensive valve that can be easily taken apart for cleaning or inspection is required, or where there is a tendency to corrode, try Fairbanks U-Bolt Valves.

Sold by distributors everywhere. Write for Fairbanks U-Bolt Catalog.

The Fairbanks Company

397 Lafayette St. New York, N. Y.

BOSTON, PITTSBURGH
Distributors in Principal Cities

Factories:
Binghamton, N.Y. Rome, Ga.

FAIRBANKS U-BOLT GATE VALVES

325 W 25th Place, Chicago, Ill. Infilco products for chemical mixing, feeding and proportioning, for hydraulic measurement and control, and for conditioning water, processing liquids and trade wastes are illustrated and described in condensed catalog No. 50.

54 CORROSION CONTROL — D W Haering & Co, Inc, 2306 S Winchester Ave, Chicago, Ill. Third edition of 16-page booklet explains and describes principles of organic and colloidal chemistry underlying application of organic chemistry to water treatment. Also incorporates additional information regarding application of organic chemistry to various industrial problems.

WELDING

55 ELECTRODES—McKay Co, York, Pa. Catalog E-16 contains information concerning selection of proper electrodes for various jobs, and includes tentative specifications for iron and steel electrodes approved by American Welding Society and American Society for Testing Materials.

56 ELECTRODES — Hobart Brothers Co, Hobart Square, Troy, Ohio. 20-page booklet covers complete line of welding accessories and electrodes. Descriptions of electrode holders, hood and hand shields, protective clothing, welding, ground, power cables and lugs also presented.

OTHER EQUIPMENT

57 METAL BELLOWS — The Fulton Sylphon Co, Knoxville, Tenn. 4-page bulletin describes Sylphon bellows, used as diaphragms in numerous pieces of equipment. Specifications and application data given.

58 VIBRATION CONTROL—The Korfund Co, 48-15 32nd Pl, Long Island City, N. Y. 8-page bulletin describes Korfund vibration control for concrete foundations. Application data included.

59 WROUGHT IRON—A M Byers Co, Pittsburgh, Pa. Bulletin "101 Uses for Wrought Iron" tells just that, and also illustrates numerous applications suggested.

60 DRAINER—Cochrane Corp, 3106 N 17th St, Philadelphia, Pa. 4-page publication No. 2925 brings up to date complete design, construction and price data on Cochrane multiport drainer.

61 BUILDING MAINTENANCE — Flexrock Co, 23rd & Manning Sts, Philadelphia, Pa. 64-page handbook is second edition of book previously published in June, 1939. Contains most of former features, together with additional technical data and a description of each of company's products.

62 BEARING ALLOYS—Lumen Bearing Co, Buffalo, N. Y. 70-page book is supplement to Lumen handbook, and details physical and metallurgical properties of latest non-ferrous bearing alloys developed by company.

63 FIRE EXTINGUISHERS—Pyrene Mfg Co, 560 Belmont Ave, Newark, N. J. Circular AD215 not only describes many classes of property for which the 1- and 1½-quart vaporizing liquid-type hand-pump extinguisher is recommended, but covers details of construction, including new "shock-absorber" pump mounting on heavy-duty model.

64 VACUUM CLEANER — National Super Service Co, Toledo, Ohio. 4-page bulletin describes work of super-service vacuum cleaner and how use of cleaner may be way to increased profits, better economies, and cleaner boilers, etc.

65 PUMPS—Taber Pump Co, 286 Elm St, Buffalo, N. Y. 12-page booklet includes rating tables, descriptions and other information concerning Taber general-purpose and sump pumps. Cross-sectional drawings show typical applications.

66 COATINGS—Flexrock Co, 23rd & Manning Sts, Philadelphia, Pa. 4-page bulletin "Colorflex" describes and applies floor coating, which is enamel-like surfacing for wood or cement floors.

67 LIGHTING—Edwin F Guth Co, 2615 Washington Ave, St. Louis, Mo. 8-page Catalog No. 36 describes three different developments: "DuoFluo," "Utility Flu-o-flector," and "Flu-o-flector Strips," fixtures for fluorescent lighting.

THE PERMUTIT COMPANY

is pleased to announce the recent issuance of the following United States Letters Patent:

Vaughan	**U.S. 2,190,853**	**issued February 20, 1940**
Liebknecht	**U.S. 2,191,059**	**issued February 20, 1940**
Liebknecht	**U.S. 2,191,060**	**issued February 20, 1940**
Smit	**U.S. 2,191,063**	**issued February 20, 1940**

● *These Letters Patent, together with other issued Letters Patent and pending applications relating to carbonaceous zeolites, their manufacture and their use in the treatment of water, are owned by, or are exclusively licensed to, The Permutit Company.*

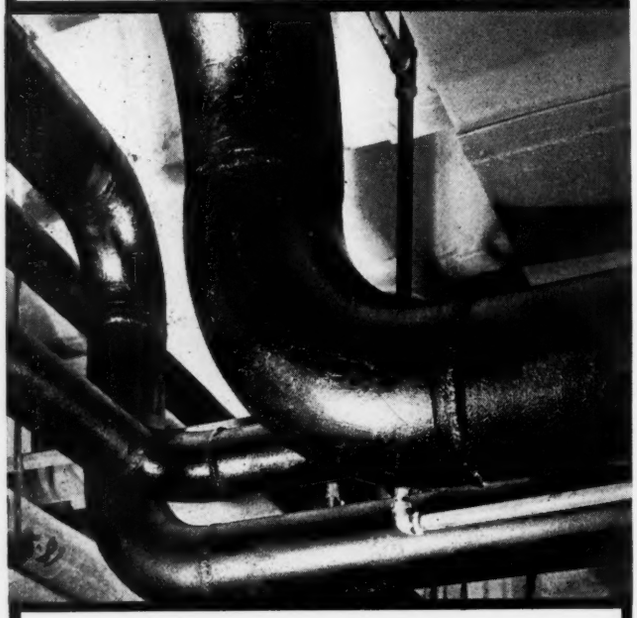
● *Carbonaceous zeolites are sold by The Permutit Company under the registered trademarks "Zeo-Karb H" and "Zeo-Karb Na."*

PERMUTIT

WATER CONDITIONING *Headquarters*

330 W. 42nd St., New York, N. Y.

Insist on these EIGHT FEATURES



–the welder knows their value

THE eight features of WeldELLS, illustrated here, do their own talking to the man who does the welding. There is no hunting for fittings, or "sizing up", because the name, size and weight are rolled into every Taylor Forge Fitting. Lining up is made easy by the quarter-markings at the ends. Welding is a quick, gratifying job thanks to the ample tangents, the clean, machine-tool bevels and the uniform accuracy of these engineered fittings.

The finished job is better too—because it is made with fittings in which all walls are at least full pipe thickness with selective reinforcement in regions where greatest strain occurs.

Ask for latest bulletin.

TAYLOR FORGE & PIPE WORKS

General Offices and Works: P. O. Box 485, Chicago

New York Office: 50 Church St.

TAYLOR FORGE

WeldELLS

Seamless Pipe Fittings for Welding

1 SEAMLESS
2 UNIFORMLY FULL PIPE THICKNESS
3 SELECTIVE, UNIFORM REINFORCEMENT
4 TANGENTS
5 MACHINE TOOL BEVELLED
6 ENDS MARKED IN QUARTERS
7 COMPLETE IDENTIFYING MARKS ON EVERY FITTING
8 A FULL LINE

Power Lines

(Continued from page 114)

functioned as an assistant sales manager.

HERBERT M ORSCHEL has joined the Perolin Co of New York as sales manager for their central division territory. Mr Orschel has been with the Johns-Manville Co, Mohawk Asphalt Heater Co, Aeroil Burner Co, and American Asphalt Paint Co, serving in various capacities.

S S WILSON, 7634 N Paulina St, Chicago, Ill., is now in charge of the Chicago territory for the Warren Steam Pump Co, Warren, Mass.

LEROY WERTZ has been named superintendent of the Lebanon, Ohio, municipal electric plant. He succeeds William Carson, who plans to resign. Wertz was previously a member of the village council, resigning to accept this position.

EDWARD D EMERSON, since 1937 district sales manager with Babcock & Wilcox Tube Co, New York, has been appointed general manager of sales for John A Roebling's Sons Co, Trenton, N. J. Mr Emerson

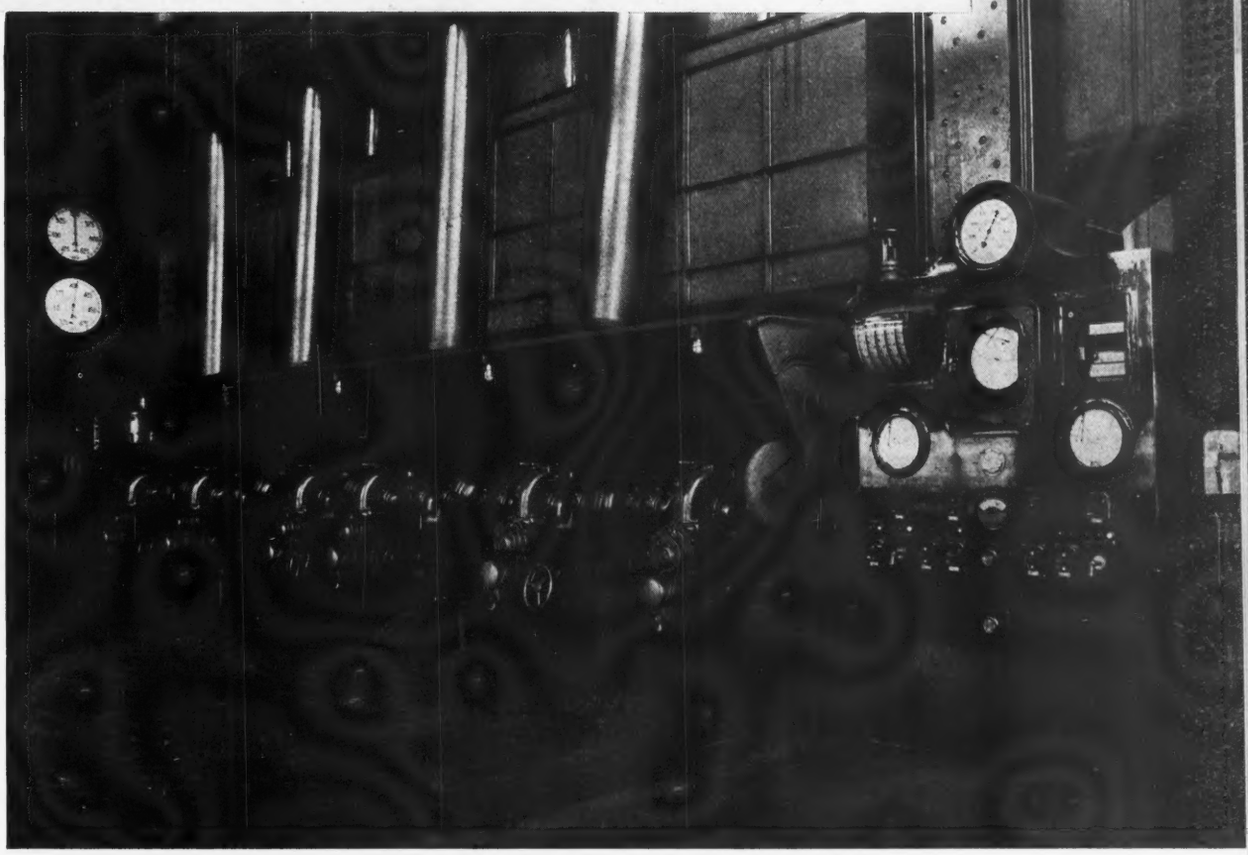
is a graduate in Mechanical Engineering, Harvard University. Previous to his employment with B&W he was for several years sales engineer with the Jones & Laughlin Steel Co.

DR A L TAYLOR, former director of the Department of Chemistry, Pease Laboratories, New York, has joined the technical staff of Oakite Products, Inc, New York, N. Y. He held his previous position for six years, and will concentrate his attention primarily on chemical research and development of cleaning materials for production and related cleaning operations of major industries.

W W WILLIAMS, general manager of the Babcock & Wilcox Tube Co, Beaver Falls, Pa., is resigning his position March 1 to go into business for himself on the Pacific Coast. He became associated with the B & W organization in 1929 as sales counselor and became successively general sales manager and general manager.

FRED E HAKER, who in 1900 joined the Allis-Chalmers Mfg Co as a stenographer, has been appointed general manager of

J&L SEAMLESS STEEL BOILER TUBES ASSURE SAFETY AND ECONOMY IN THE MAINTENANCE AND OPERATION OF YOUR BOILERS • • • •



J & L Boiler Tubes keep boilers working efficiently and economically because into every length of J & L seamless tubes is built an extra margin of strength and safety. There are no welds; therefore, there can be no failure at or near a weld — boilers stay on the job longer with fewer costly shut-downs.

When replacements or repairs are necessary, J & L Boiler Tubes form easily, roll in faster and they "stay put." Installations in power and manufacturing plants all over the country are proving that J & L Seamless Steel Boiler Tubes help make maintenance dollars go further.

The next time you need boiler tubes, specify J & L Seamless. Make sure you get tubes that give you low installation cost and last longer. Write today for a copy of the J & L Seamless Steel Boiler Tube Bulletin.

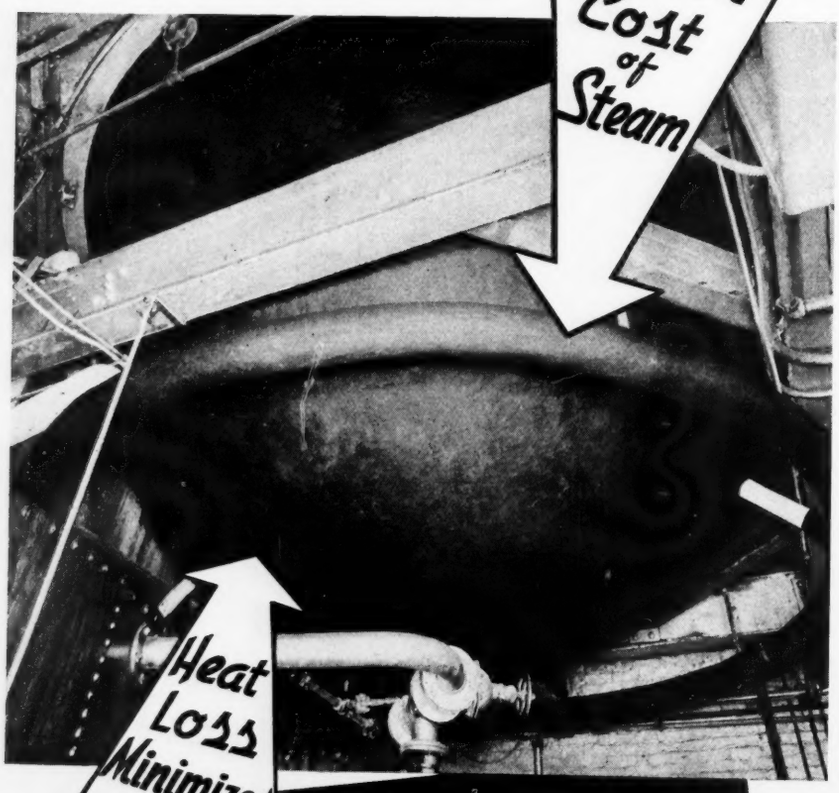
J & L — PILOTS THE COURSE OF CONTROLLED QUALITY IN STEEL

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS
PITTSBURGH, PENNSYLVANIA

J&L STEEL

You're looking up at a 250 bbl. capacity copper Brew Kettle insulated with BALDWIN-HILL No. 1 INSULATING CEMENT, 2½" thick, reinforced with 1" galv. wire mesh and finished with ¼" coat of B-H WEATHER-SEAL. Circular steam header is insulated with B-H NO. 100 PIPE COVERING and finished with WEATHER-SEAL.



with

BALDWIN-HILL

No. 1 INSULATING CEMENT

The high adhesiveness and low volume shrinkage of BALDWIN-HILL No. 1 INSULATING CEMENT prevents breaking away at the edges and cracking usually encountered in insulating equipment of this sort—expanding and contracting due to periodic heating and cooling. And for such irregularly shaped equipment; for working in tight places—B-H No. 1 Insulating Cement is your one best bet.

Highly Effective up to 1800° F.
100% Reclaimable up to 1200° F.
Easy to Mix and Apply

Send for Catalog showing Complete Line of HEAT INSULATION PRODUCTS

BALDWIN-HILL CO.
575 Klagg Ave. Trenton, N. J.

BALDWIN-HILL B-H INSULATIONS

purchases. From his original position he worked in several other capacities, all leading up to assistant manager of purchases, a position to which he was appointed in 1916. In his new position he will be in charge of spending about $45,000,000 in 1940, according to an announcement made recently by the company.

ROY W EMERSON has been appointed metallurgist and special welding engineer for the Pittsburgh Piping & Equipment Co. After graduating from the University of Michigan where he majored in chem and met engineering, Mr Emerson joined the research laboratory of the Carnegie Illinois Steel Co at S Chicago, Ill. He came to Pittsburgh Piping & Equipment Co from Westinghouse Elect & Mfg Co, where he was engaged in welding research. He will be in charge of the metallurgical laboratory and will supervise the welding procedure and welding personnel.

G J KEADY has been elected executive vice-president of the Sharples Corp, Philadelphia, Pa. Previous to his election he was general sales manager. He is an alumnus of the University of Pennsylvania.

GEORGE W PLAISTED, vice-president of the Austin Co in charge of West Coast operations for the past seven years, has been named vice-president and general sales manager of the company with headquarters at Cleveland. A native of Worcester, Mass., and a graduate of the Worcester Polytechnic Institute, has been associated with national engineering and construction organization since 1916. He joined the Austin staff as a structural and reinforced concrete designer, serving later as structural engineer and district estimator.

ROBERT H EMERICK has been appointed assistant sales manager of the Stowe Stoker Div, Johnston & Jennings Co, Cleveland, Ohio. He comes to the company directly from the Henry Vogt Machine Co, where he had been in charge of boiler sales in the New York and New England areas for the past 18 months. Previous to that time he had a varied career which took him on many engineering projects throughout the world.

PROF HARRY MCCORMACK, director of chemical engineering at Armour Institute of Technology, was recently elected president of the Illinois Engineering Council. His election took place at the annual meeting of the Council held at the Institute. He is a member of the American Chemical Society, American Institute of Chemical Engineers, chairman of the laboratory committee of the Chemical Engineering Div of the Society for the Promotion of Engineering Education, and technical advisory editor of *Equipment Review*.

SIDNEY D WILLIAMS has been appointed vice-president in charge of sales of the Steel Div of Copperweld Steel Co, Warren, Ohio. Following his graduation from Lehigh University he held numerous positions up to 1926, from which time he has been, respectively, metallurgical sales engineer, assistant director of sales, manager of tube sales and director of sales for the

How Hall Service Saved the Cost of a New Boiler Plant

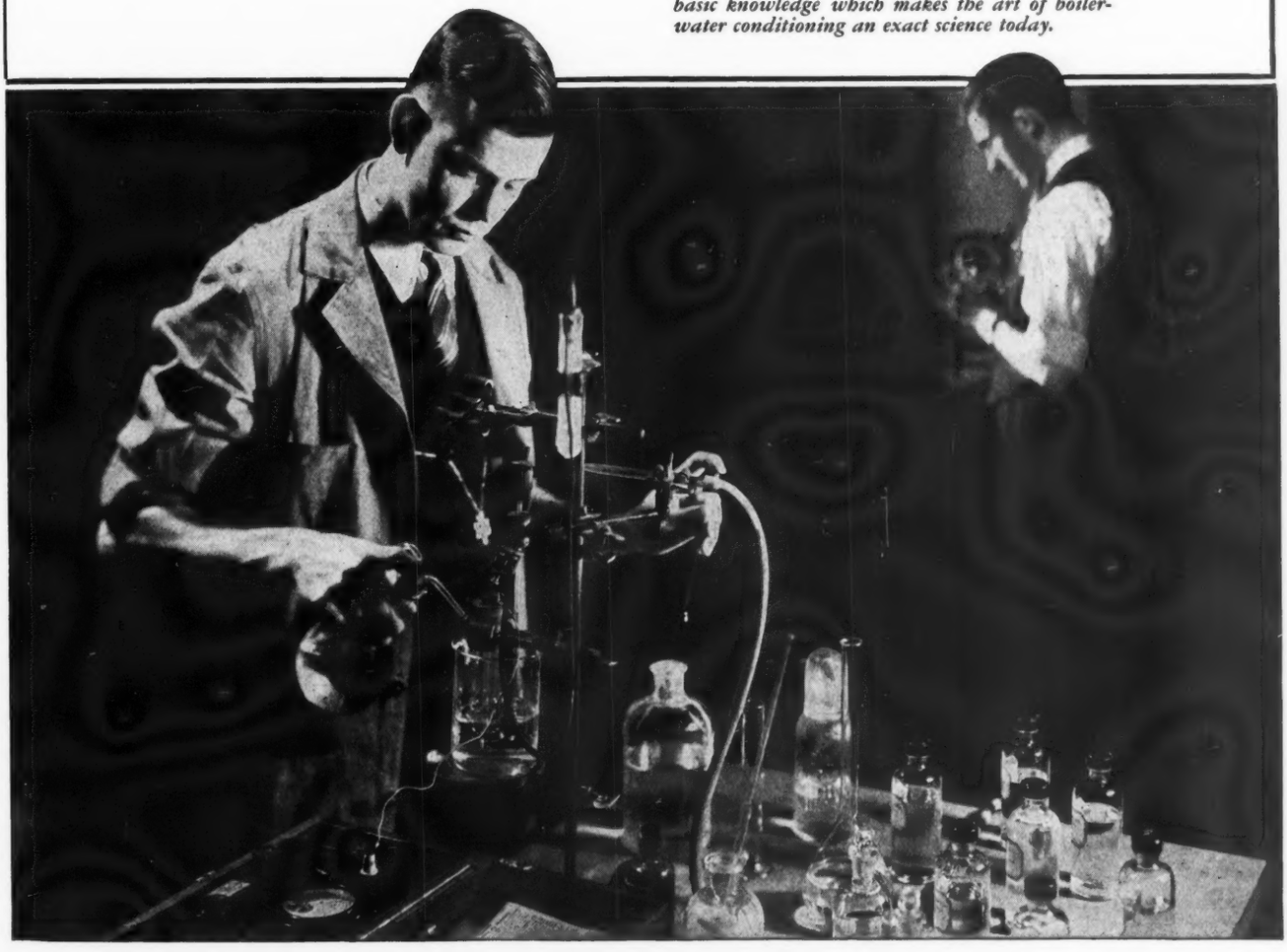
STEAM demand in a large industrial plant had increased so much that existing equipment was apparently inadequate. A survey by Hall engineers showed that the fault was not in the size of the plant but with the operation. Scale was so bad that boilers were being continually taken off the line for cleaning. The plant seldom operated at full capacity.

We put a stop to that situation! When Hall Service went into operation, boilers stayed on the line. Scale was prevented. Efficiency of each unit was increased. The plant was able to handle the entire load easily.

This occurrence is common in times of increasing production. Hall Service often improves the operation of existing equipment enough to handle peak loads and save the cost of new units.

Hall chemical engineers are responsible for conditioning the boiler feedwater in thousands of the finest power plants in the United States and abroad. Their accurate knowledge of what goes on in boilers is your best insurance against boiler troubles caused by scale, corrosion, embrittlement and wet steam. You can entrust your most difficult problems to them with entire confidence. Hall Laboratories, Inc., 304 Ross Street, Pittsburgh, Pa.

HALL CHEMICAL ENGINEERS *are recognized the world over as the leading authorities on boiler-water problems. Through their efforts came the basic knowledge which makes the art of boiler-water conditioning an exact science today.*



HALL SYSTEM *of Boiler Water Conditioning*

What Kind of Water

The kind of *water* supplied to your boiler has a vital bearing on the kind of *service* you receive. If the water is not precisely correct, sludge, scale and corrosion combine to defeat efficiency —costing you important money over the years for extra fuel and maintenance—money, a part of which could better be spent for a SCAIFE SYSTEM installation to end these evils once and for all.

Let *The Scaife Man* give you the practical details of the benefits *you* would derive from a dependable supply of pure, Scaife-Conditioned Water, plus an analysis of your present feed-water condition—quite without obligation!

FOUNDED SCAIFE 1802

WM. B. SCAIFE & SONS CO.

General Offices, Laboratory and Works—OAKMONT, PA. (Pittsburgh District)

Representatives in Principal Cities

Timken Steel & Tube Div, Timken Roller Bearing Co, Canton, Ohio.

ROBERT W CRANE, until recently sales representative of the New York Belting & Packing Co covering western New York and northern Pennsylvania, has been transferred to Minneapolis. He will be succeeded by Edward B Gunniffe, who will make his headquarters at Rochester. Mr Crane in his new position will cover northern Iowa, northern Wisconsin, Minnesota, North and South Dakota, and northeastern Montana.

C A SMITH, formerly switchgear superintendent of the East Pittsburgh Div, Westinghouse Elect & Mfg Co, has been appointed manager of the East Pittsburgh Factory Service Div, succeeeding the late F J Shiring. Mr Smith has been associated with Westinghouse since 1892, when he became an apprentice. He has served as assistant foreman, general foreman, assistant superintendent, superintendent and division manager.

H P BINDER has been chosen assistant manager of the Centrifugal Pump Div, Allis-Chalmers Mfg Co. He is a graduate of the School of Electrical Engineering at Purdue University and was selected to enter the Allis-Chalmers Graduate Training Course in 1911. At the conclusion of the war, where he saw service, he resigned the rank of captain and returned to the company in 1919. In the company's Centrifugal Pump Div he took up sales engineering work, which he continued until his present appointment.

ARTEMAS E WARD has been admitted as a partner in firm of Cheney & Foster, 61 Broadway, N. Y. He has been connected with W S Barstow & Co for 25 years, and also with the Utility Management Corp.

ARTHUR W FERTIG, chief engineer of the Monroe County Court House, Rochester, N. Y., will celebrate on March 22 the 45th anniversary of his connection with this institution. Mr. Fertig, a native of Rochester, is active in engineering fraternal circles; is treasurer of the Flower City No. 3, NAPE; and a member of Rochester Council No. 4, Universal Craftsmen Council of Engineers.

NATHAN A COVEY, chief engineer of the Ludlum Steel Co, Fredonia, N. Y., was elected president of the newly-formed Fredonia-Dunkirk Branch 8 of the NAPE. Other officers are Charles A Burkholder, vice-president; Gerald C Stoyle, treasurer; Rudolph H Karl, secretary, Thomas Barry, doorkeeper; Amos Baker, conductor; and Henry Newman, Lavern Phelps and Harry Kraiger, trustees.

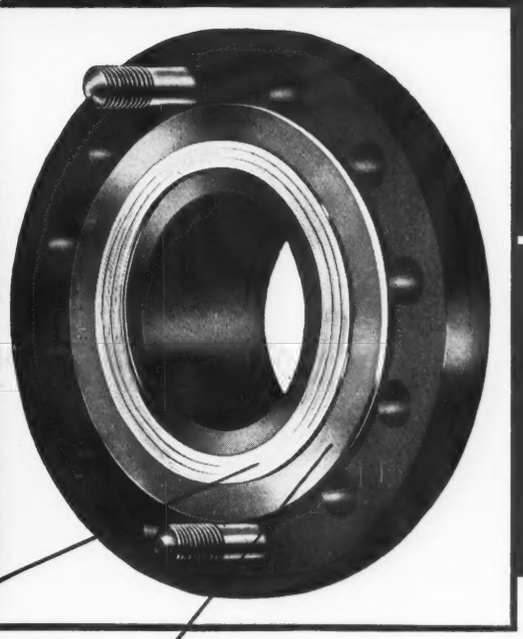
BUSINESS ITEMS

YORK ICE MACHINERY CORP, York, Pa., announces several official changes. William S Shipley, president of the company for the past ten years, was elected chairman of the board of directors and Stewart E Lauer, formerly vice-president, was elected president. Elmer A. Kleinschmidt was elected executive vice-president and Llewellyn Williams, vice-president in charge of engineer-

For high-pressure flanged joints

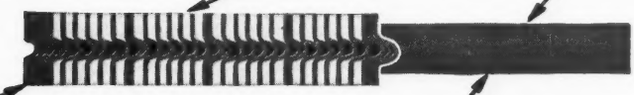
FLEXITALLIC STYLE C-G GASKETS

Applicable to Raised Face, Smooth Face, Van Stone or Cranelap Fittings.



Safety and springiness contributed by a spiral wound member.

Solid metal member acts as a compression gauge and assures correct bonding load.



Construction of each spiral wound member is governed by design of fittings and by the required bonding load for working pressure and temperature.

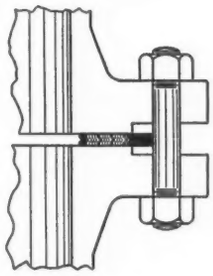
When the spiral wound member is compressed so that the flanges bear on the solid ring, then the correct bonding load is on the gasket without over-stress of bolts or flanges.

For 28 years, Flexitallic Gasket Company has anticipated demands by industry for spiral-wound gaskets capable of holding increased pressures and temperatures.

The greatest improvement is the Flexitallic C-G Gasket. Its outside metal ring acts as a compression gauge, so that you know when the gasket is correctly compressed. This ring also provides complete confinement of the gasket member. Therefore, this gasket is absolutely safe.

You can replace the gasket proper using the compression ring innumerable times. This reduces your replacement cost. The gasket is easy to install, is safe, foolproof and economical.

Flexitallic Gaskets are constructed according to the engineering requirements of the individual installation.



Diagrammatic section of a CG Gasket with typical Raised Face fittings showing the flanges compressed to the thickness of the solid metal member.

"Flexitallic" Reg. U.S. Pat. Office

As the first step in the satisfactory solution of your gasketing problems, write on your letterhead to Dept. A for our C-G bulletin, or, better still, detail to us your gasket troubles.

Patents are pending for the Style C-G Gasket.

FLEXITALLIC GASKET CO., 8th and Bailey Streets, Camden, N. J.

Originators of Spiral Wound Construction

Select a name that ends in "O"
Then packing judgment you will show
For the "O" is a sign
Of the Greene, Tweed line
And that is tops as we all know.

YES, Greene, Tweed packings do give you a bigger packing dollar. Service records show that they stand up longer, stay tight, reduce shaft wear and do not blow out. The reasons? . . . stronger fibre structure and a lubrication that penetrates and surrounds each and every strand. If you are now using a Greene, Tweed packing for some particularly tough operation in your plant, remember that the other Greene, Tweed brands will do other jobs just as efficiently. The Greene, Tweed line is preeminent for superior service and is recognized by the "O" at the end of the name.

PALMETTO
for steam, air, hot fluids

PALCO
for water

PELRO
for solvents, oils

CUTNO
for alkalis

GLASO
for acids

●

DON'T TAKE OUR WORD

Let us send you a free working sample. Give it your toughest job. Then you will know how long lived and efficient packing can be.

GREENE, TWEED
SELF-LUBRICATING
PACKINGS

GREENE, TWEED & CO., 101 Park Ave., New York, N. Y.

ing. Samuel K Shipley was elected vice-president and treasurer, and Vincent W Keesey, secretary.

DETROIT REX PRODUCTS CO, Detroit, Mich., has announced following promotions: H R Norgren has been made assistant general sales manager in charge of special accounts; D E Williard, assistant general sales manager in charge of regions and branch offices; and R A O'Reilly, manager of Dry Cleaning Div. E L McIlhenny has also been appointed manager of Alkali Div.

UNITED CONVEYOR CORP has recently appointed Frank Howell Co, 318 American Bldg, Richmond, Va., district sales representative.

The Richmond, Va., district office of ALLIS-CHALMERS MFG CO, C L Crosby manager, has moved to new location, the Richmond Trust Bldg. The Rockford, Ill., district office, of which J Breutzman is in charge, will hereafter be located in the Gas-Electric Bldg.

CURTIS PROPELLER DIV, CURTISS-WRIGHT CORP, leased on Jan 8, 1940, 2-story brick building for additional plant area. Total area held by the company is approximately 200,000 sq ft.

SHAFER BEARING CORP, Chicago, announce the appointment of Transmission Engrg Co, of San Francisco as direct factory representative for Shafer line. Offices are located at 259 Second St, San Francisco, Calif.,

WARD LEONARD ELECTRIC CO announces change in address of representative, Northwestern Agencies. New office is located at 2411 First Ave, Seattle, Wash.

IRON & STEEL PRODUCTS, INC, Chicago, Ill., announce the establishment of a Merchant Iron & Steel Dept under the direction of J C Beggs, formerly of Joseph T Ryerson & Sons, Inc.

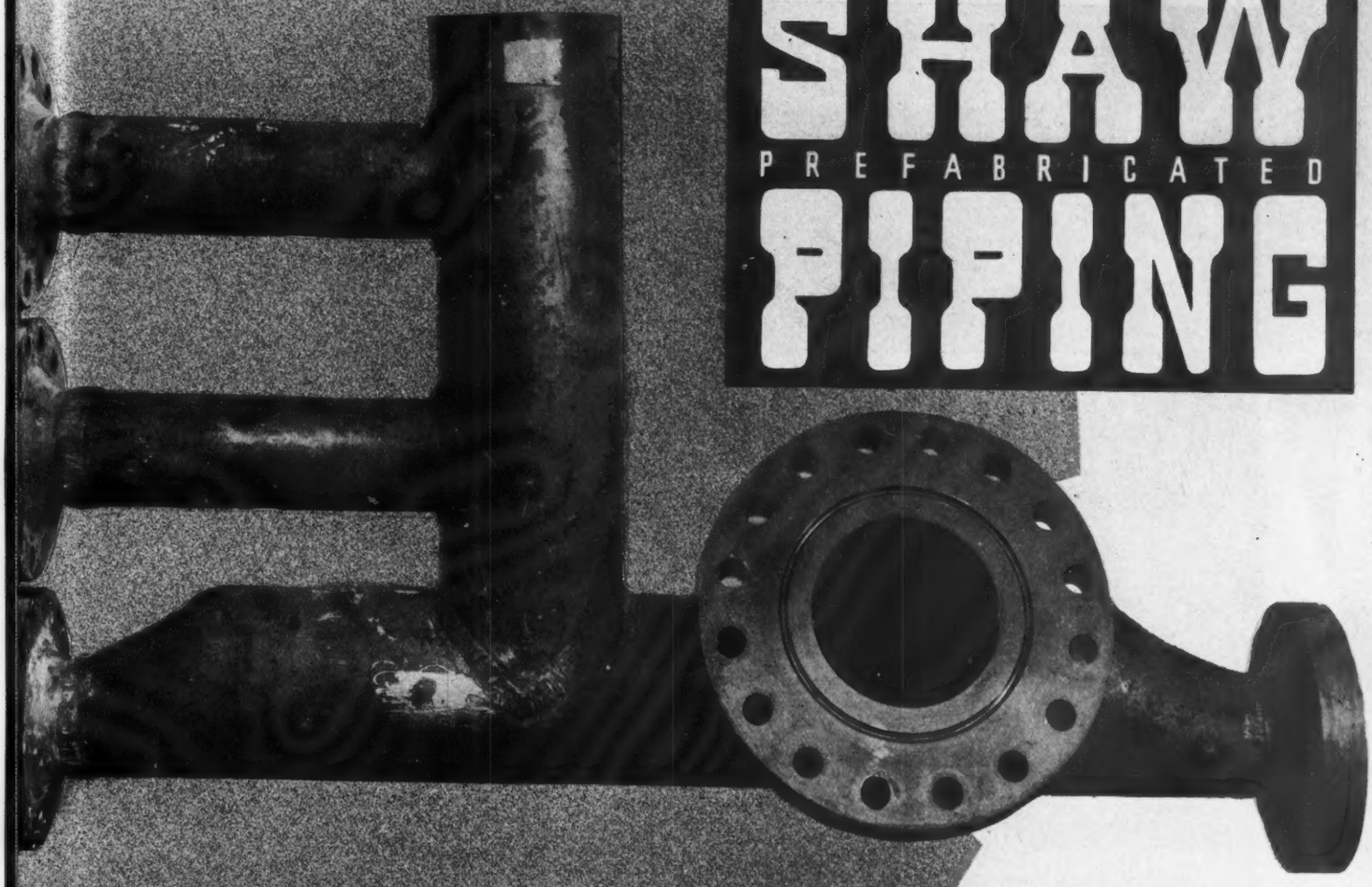
ANGLO-FRENCH PURCHASING COMMISSION has taken over third floor of Hibbs Bldg, Washington, D. C., and will establish offices there. Miller Hyde is in charge.

OHIO GREASE CO, Loudonville, Ohio has opened a sales and engineering office at 342 Madison Ave, New York, N. Y. The office will be in charge of R G Bayman, eastern district manager.

INDUSTRIAL UNIT HEATER ASSN at its annual meeting on Jan. 22 elected C C Cheyney, president; Albert J Nesbitt, vice-president; and L O Monroe, secretary-treasurer.

YORK ICE MACHINERY CORP announced appointments of John R Hertzler and Ralph B Meisenhelder as general sales manager and assistant to the president respectively. Hertzler has been with York since 1927, and previous to his appointment was general representative.

In January the UNIT HEATER & COOLER CO was taken over by D J Murray Mfg Co, the parent Co. The Unit Heater & Cooler Co was established in 1929 by the Murray



SHAW PREFABRICATED PIPING

cked by 48 Years Experience

Geared for every type of Intricate Work for Power and Industrial Plants

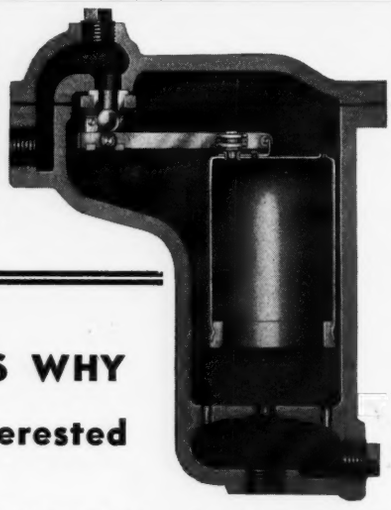
BENJ. F. SHAW COMPANY

2nd & Lombard Streets, Wilmington, Delaware

PIPING FABRICATORS AND CONTRACTORS

MEASURE SPEED
without even seeing
the rotating element!
FRAHM TACHOMETER
Because they measure speed simply by contact
"FRAHM" VIBRATING-REED TACHOMETERS
are the solution to a wide variety of speed-measuring problems, as well as for indicating rates of vibration. Types for permanent mounting as well as for hand use.
Write for descriptive Bulletin 1590-P.
JAMES G. BIDDLE CO. 1211-13 ARCH STREET PHILADELPHIA, PA.

CRYER STEAM TRAPS



ACCESSIBLE
POSITIVE
QUICK
VENTING

10 REASONS WHY you'll be interested

1 **ACCESSIBILITY**—cover plate and all mechanism may be removed without disconnecting any piping.

2 **POSITIVE ACTION**—correct seating insured by free turning ball valve—quick venting valve eliminates balancing and dribbling.

3 **QUICK VENTING**—rapid discharge of air without regard to temperature is assured by mechanically controlled quick venting valve.

4 **LARGE CAPACITY**—baffle plate prevents sudden surges from lifting bucket and closing valve—quick venting speeds action—large orifice in valve seat.

5 **LOW MAINTENANCE**—stainless steel wearing parts—ball valve free turning distributes wear—valve seat easily removed—cleaning is simple through test and drain outlets.

6 **EASILY INSTALLED**—inlet connections made through bottom or side—no special supports required.

7 **WILL NOT AIR BIND**—all air discharged before condensate through valve at top of trap.

8 **INTERCHANGEABILITY** — parts individually serviced.

9 **COST**—quickly repaid in savings and higher efficiency.

10 **GUARANTEE**—will discharge condensate at rated capacities—will operate satisfactorily within limits of pressure and capacity.

Write for complete details of sizes, capacities available and prices.

CRYER TRAP & VALVE CO., INC.
Manufacturers of Steam Specialties for more than 40 years.
366 Madison Ave., New York, N. Y.

Mfg Co as the sales organization for unit heaters. According to the company, the heaters have become so well known that the sales company is no longer to be separate.

FAIRBANKS, MORSE & Co have moved from 165 Broadway to new office in Maritime Exchange Bldg, 80 Broad St, New York, N. Y.

AMERICAN MACHINE & METALS, INC, has announced the appointment of George Koch Sons, Inc, as exclusive agents in Evansville, Ind., for their line of DeBothezat ventilating equipment.

GENERAL ELECTRIC SUPPLY CORP, will move from its offices at 200 S 7th St, St. Louis, Mo., to new quarters at 2653 Locust St, northeast corner of Besmont. A E Shirley is district manager of the plant, a subsidiary of G-E Supply Corp, Bridgeport, Conn.

Engineers' Books

AC Energy

THE MEASUREMENT OF ALTERNATING-CURRENT ENERGY (First Edition, 1940). *By Donald T Canfield, Associate Professor of Electrical Engineering, Purdue University. Published by McGraw-Hill Book Co, 210 pages, 5½ x 8 in., 73 illustrations, cloth binding. Price $2.00.*

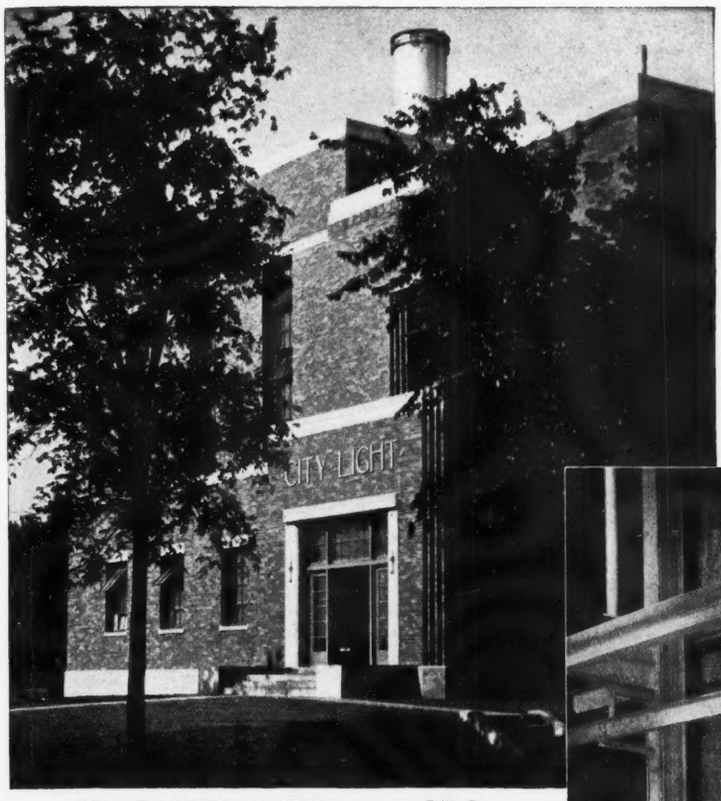
This book deals with the measurement of alternating-current energy and therefore with the induction-type watthour meter and its application. In it the author has attempted to answer four questions: What makes the disk in a meter go around? How can this revolving disk be made to measure energy? What metering scheme should one use to measure the energy of a particular circuit? How may one be sure that all the energy in such a circuit is metered by a particular metering scheme?

The first chapter of 40 pages gives a fairly complete history of the development of the watthour meter. Beyond this, the treatment is largely a mathematical analysis of metering problems, thereby limiting use of the book to meter engineers and technical students.

Power

STEAM, AIR AND GAS POWER (3rd Edition, 1939). *By William H Severns, University of Illinois, and Howard E Degler, University of Texas. Published by John Wiley & Sons, 440 Fourth Ave, New York, N. Y. 511 pages, 6 x 9 in., 262 illustrations, tables and problems, cloth binding. Price $4.00.*

Revised edition of this standard text has been rewritten and augmented to include new steam tables as well as current development in steam-generating equipment, turbines and internal-combustion engines. Users of previous editions are familiar

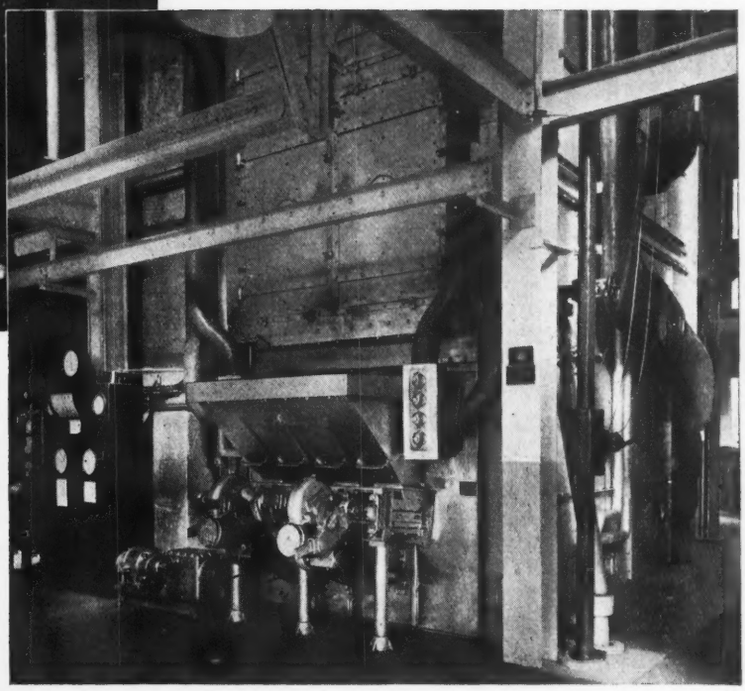


City Light Plant—Kalamazoo, Mich.

DIRECT TO YOU

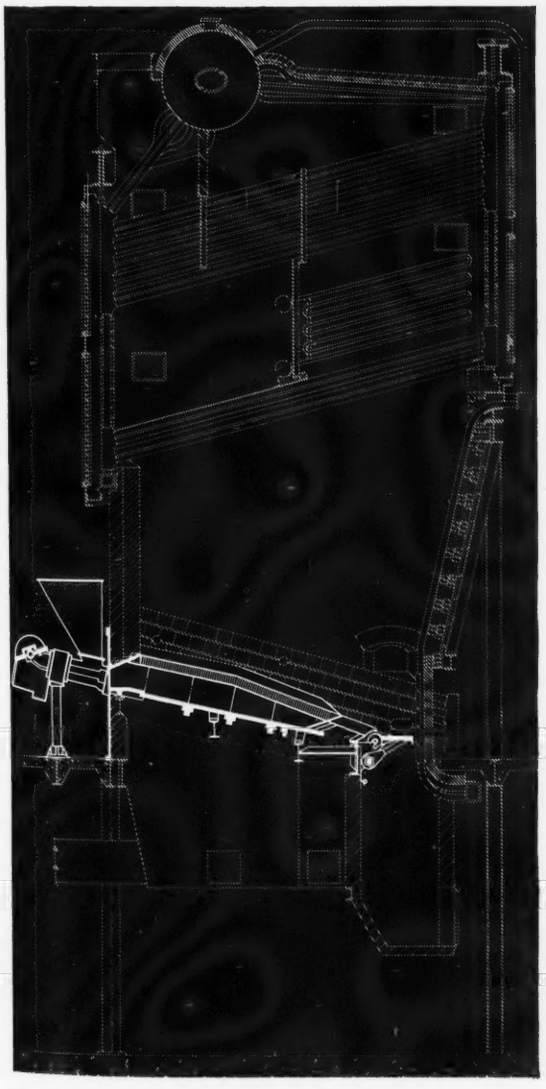
KALAMAZOO

DETROIT STOKER



*Detroit Multiple Retort (Type MC) inclined Stoker at City Light Plant, Kalamazoo, Mich.

Earl E. Norman, General Supt. • Ralph M. Emmons, Power Plant Supt. Burns & McDonnell, Kansas City, Mo., Consulting Engineers.



● We are proud to have participated in the recently completed expansion program of the CITY LIGHT PLANT, KALAMAZOO, MICHIGAN. Detroit Multiple Retort Stoker has these features:

- Inclined retorts of graduated depth insure effective underfeed action.
- Adjustable moving retort bottoms insure proper fuel distribution.
- Stroke of each large square ram is individually controlled.
- Extension moving grate sections at the rear have a slicing action on the fuel bed.

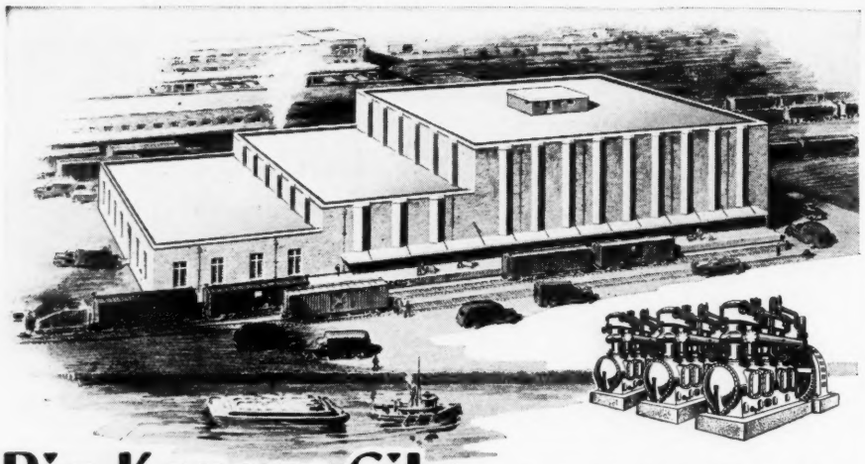
Efficiencies in excess of 80% are secured

WRITE FOR BULLETIN 130

DETROIT STOKER COMPANY

SALES AND ENGINEERING OFFICES
GENERAL MOTORS BUILDING
DETROIT • MICHIGAN

MAIN OFFICE AND WORKS
MONROE • MICHIGAN
District Offices in Principal Cities



Big Kansas City Food Terminal to have

TRADE FRICK MARK

For cooling 1¼ million cubic feet of storage space, and freezing 160 tons of ice daily.

Three big Frick 4-cylinder compressors, and a large 2-cylinder Frick machine, will carry the refrigerating load. Architect is Jos. W. Radotinsky. The plant is in Kansas City, Kansas.

For that important refrigerating, ice-making, or air conditioning job of yours, get quotations from the nearest Frick Branch Office or Distributor.

FRICK CO., Waynesboro, Penna.

Refrigerating & Ice-making Equipment

SCHRAMM

AIR COMPRESSORS

Deliver air at low cost exactly where you need it!

You can save money in your plant by installing SCHRAMM AIR COMPRESSORS.

These modern units—correctly engineered and designed for high efficiency and low power consumption — can be placed in any convenient location. Their vertical cylinders, cast enbloc, insure a compact design which requires a minimum of floor space. Perfect balance eliminates the need for foundation. Ability to install the unit close to the point where air is needed, reduces piping costs. Integral cooling saves water and insures uniform temperature for proper lubrication.

These and many other features and advantages are fully described in Bulletin #3907—sent FREE on request.

SCHRAMM, INC., WEST CHESTER, PA.

ESTABLISHED, 1900

with chapters on fuels and combustion, firing equipment, condensers, pumps, air compressors, oil and gas power, etc. These have been brought up to date and the book in its present form views the field of modern power generation in very broad perspective for anyone moderately conversant with elementary mathematics and thermodynamics.

Materials

ENGINEERING MATERIALS (1st Edition, 1939). *By A H White, University of Michigan. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y. 547 pages, 6 x 9 in., 200 illustrations, cloth binding. Price $4.50.*

One constantly heard demand of recent years has been for better, stronger, more resistant materials to wear longer at old jobs and make possible new applications in and around a power plant. No longer can an engineer meet all the problems of corrosion and high temperatures with metals alone, or, say, with clays and cements. Nor can he hope to become an up-to-date metallurgist, geologist, and chemist in a few hours of spare time. This much-needed book by Professor White, acknowledged authority, not only covers completely the metallurgy and heat treatment of iron, steel and their alloys, but covers alloys of copper, aluminum and lead, discusses the mechanism of corrosion, and has chapters on rocks, clay and silicates.

Because they have a bearing on the materials problem, the book also covers fuels and combustion, water and its treatment, and organic preservative materials. Intended primarily as a textbook, it will also be found useful to any engineer looking for fundamentals of modern power-plant materials.

Brief Reviews

MEASUREMENT OF FLUID FLOW WITH ORIFICES—*By Professors F C Stewart and J S Doolittle, Pennsylvania State College. Published by Instruments Publishing Co, 1117 Wolfendale St, Pittsburgh, Pa. Approximately 100 pages, heavy paper cover. Price $1.00.* Originally published in *Instruments*, article was reprinted and bound. Deals with the measurement of fluid flow with orifices, nozzles, venturi tubes, etc.

EQUIPMENT STANDARDS—*Formulated by Refrigerating Machinery Association, Southern Bldg, Washington, D.C. Parts I & II, 28 pages; parts I & II, Supplement "A", 16 pages. Main section price $.50, supplement, $.25.* Part 1 consists of standards for enclosed ammonia compressors, vertical open-shell and tube ammonia condensers, horizontal closed shell and tube ammonia condensers, horizontal closed ammonia shell and tube brine coolers (flooded), submerged open ammonia brine coolers, ammonia liquid receivers, ammonia mains, steel and wrought-iron pipe, and cold-storage-room insulation. Section 2 deals with shell-and-tube or shell-and-coil condensers and Freon-12 water coolers. Base specifications for self-contained ammonia units, am-

YOU ARE IN *Good Company* WHEN YOU BUY

This is a representative list of the constantly growing number of outstanding firms using Buell equipment for dust collection or fly ash correction. Star (*) indicates *re-orders* as a result of the satisfactory operation of initial Buell installations.

***FORD MOTOR COMPANY**
5 separate installations at Dearborn, Mich.

***LONE STAR CEMENT CORPORATION**
Norfolk, Va., and Spocari, Ala.

DOW CHEMICAL COMPANY
Midland, Mich.

***WISCONSIN ELECTRIC POWER COMPANY**
2 separate installations at Milwaukee, Wis.

***LEHIGH PORTLAND CEMENT COMPANY**
Union Bridge, Md., Sandts Eddy, Pa., Fordwick, Va., Oglesby, Ill.

INTERNATIONAL PAPER COMPANY
New York, N. Y.

THE DETROIT EDISON COMPANY
Detroit, Mich.

***MEDUSA PORTLAND CEMENT COMPANY**
Wampum, Pa., and York, Pa.

***AMERICAN POTASH & CHEMICAL COMPANY**
4 separate installations at Trona, Calif.

KOSMOS PORTLAND CEMENT COMPANY
Kosmosdale, Ky.

CONGOLEUM-NAIRN, INC.
Kearny, N. J.

REGAL LAUNDRY, INC.
Baltimore, Md.

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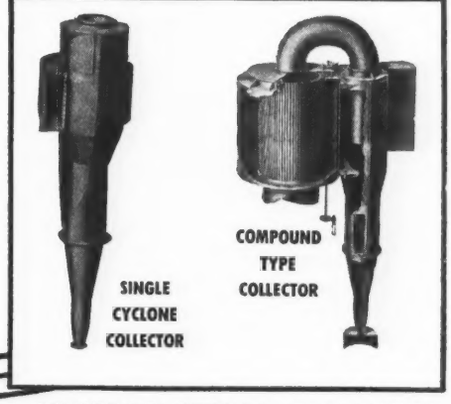
DUST COLLECTORS

● More than 1200 companies throughout the world are now using the patented Van Tongeren System used exclusively in Buell Equipment. The Van Tongeren cyclone, *with its dust pocket*, offers these important advantages:

HIGH EFFICIENCY
LOW FIRST COST
NEGLIGIBLE MAINTENANCE
LONG, TROUBLE-FREE LIFE

Submit your dust collection or fly ash correction problems to the Buell Testing Laboratory for sound, impartial advice. Write today for "DUST COLLECTION" and "FLY ASH CONTROL"—two informative booklets, either or both of which will be sent on request, without obligation.



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BUELL ENGINEERING COMPANY, INC.

Wherever located, you will be quickly served through sales offices of either BUELL ENGINEERING CO., or B. F. STURTEVANT CO.

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LESS AIR CONSUMPTION— *GREATER* CLEANING POWER

The new Wilson EP (Extra Power) Series Heavy Duty Air Motors use less air—from 25% to 40% less—yet they have from 5 to 10 times the torque and deliver from 30% to 75% more power to the cutter head *at the tube walls.* This has been proved time after time under actual operating conditions — not laboratory "demonstrations".

Especially designed for use where very hard or very heavy deposits must be removed, they clean *cleaner, faster* and more economically. If you want the most efficient and most economical tube cleaning equipment, use a Wilson EP (Extra Power) Series Heavy Duty Air Motor.

Write for the name of our representative nearest to you or send for our new thirty-six page catalog fully describing and illustrating the complete line of Wilson Tube cleaning equipment.

THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
55 Vandam Street New York City

• clearances controlled—
• oil pressure maintained

On this diesel, LAMINUM babbitted shims (pat'd) are standard . . . for the important oil pressure control and precision adjustment of main and connecting rod bearing clearances. The same easy accuracy in service adjustments as in assembly! You simply peel off .002 in. (or .003 in.) laminations. Always a clean shim surface! Laminum sample on request.

LAMINATED SHIM CO., INC. 21-74 44th Ave., Long Island City, N. Y.
Cleveland Detroit Milwaukee
929

LAMINUM
Precision adjustment SHIMS

monia-brine-cooler ratings, Freon-12 mains and standard nomenclature for reciprocating compressors are all included in the supplement to parts 1 and 2.

FUNDAMENTALS OF SMOKE ABATEMENT—*By J F Barkley, supervising engineer, Fuel Economy Service, Bureau of Mines. 60 pages, including charts. No price listed.* Consists mainly of partly abridged paper presented at an engineering conference in 1938, and includes statistics gathered from all over the United States concerning the presence of dust and flyash, etc.

YOUR INCOME TAX (1940 Edition)—*By J K Lasser, CPA. Published by Simon & Schuster, New York. Paper bound, 128 pages, specimen income tax returns. Price $1.00.* Telling the average man and woman about income tax is quite a job, but this volume does so, listing all the deductions to which a person is entitled. Not only does it give these deductions, but also summarizes the more important changes in the law, and tells how to prepare a return quickly and correctly.

POSSIBILITIES OF RESEARCH IN THE GASIFICATION OF COAL—*By C A Barnes, Battelle Memorial Institute Published by Bituminous Coal Research, Inc, 803 Southen Bldg, Washington, D.C. 36 pages, with 9 tables. Price $.15.* After going into several of the preliminary considerations, such as the present status of the gas industry, present gas manufacturing methods, and thermal efficiencies of manufactured gas processes, technical report No. 5 covers recent trends in and possible processes for the complete gasification of coal. Continuous gasification of pulverized coal by external heating is considered, along with several other methods and processes.

A S R E CODES—*Published by American Society of Refrigerating Engineers, 37 West 39th St, New York, N. Y. Price 20 cents each.* "Proposed Standard Methods of Rating and Testing Self-Contained Air Conditioning Units for Comfort Cooling" is preliminary version of code which will later be revised and adopted. Second publication, "Standard Method of Rating and Testing Refrigerant Expansion Valves" gives approved methods of rating thermostatic expansion valves, testing thermostatic expansion valves, and rating and testing automatic expansion valves.

RESULTS OF MUNICIPAL LIGHTING PLANTS—*Published by Burns & McDonnell Engrg Co, Kansas City, Mo. (6th Edition–1939). 350 pages, many graphs, charts and tables. Paper bound, price $5.00.* Electric rate book shows operating records, output, rates, revenues, valuation and other information as to the use and cost of electricity in more than 700 municipally owned plants throughout the country.

AVERAGE ELECTRIC BILLS—*Published by Federal Power Commission (Publication FPC–R–17). 80 pages of tables, graphs and maps. Sold only by Federal Power Commission. Price 10 cents.* Bulletin contains, in addition to regular informa-

(*Continued on page* 156)

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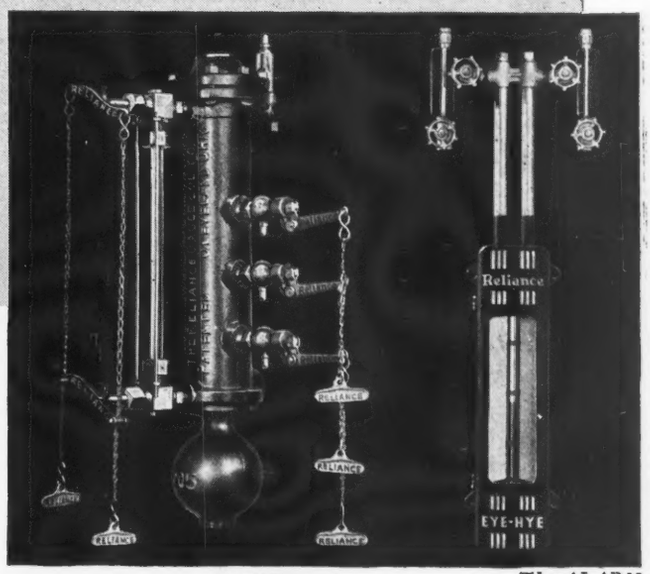
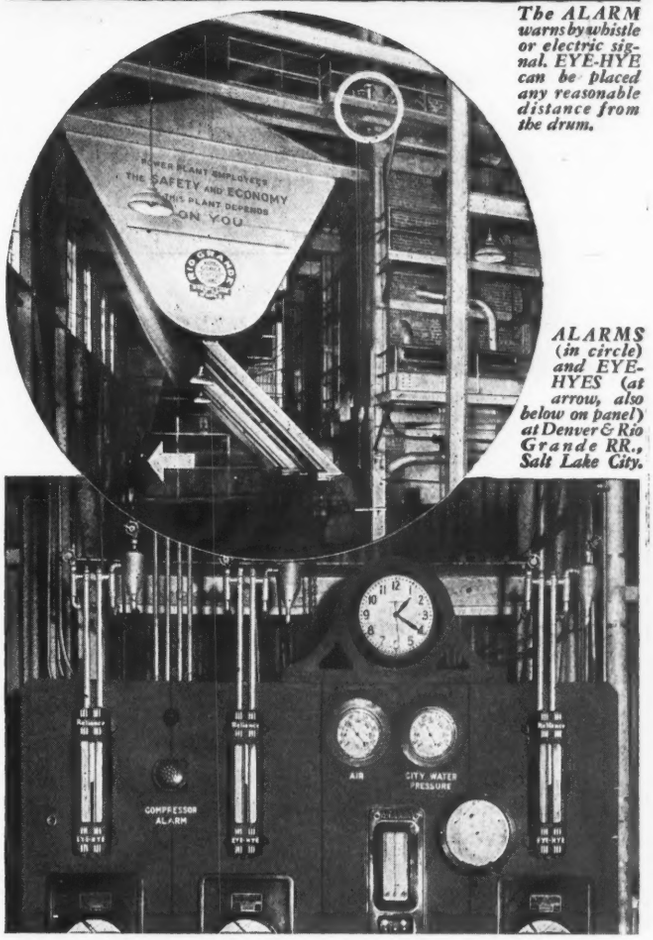


The ALARM warns by whistle or electric signal. EYE-HYE can be placed any reasonable distance from the drum.



ALARMS (in circle) and EYE-HYES (at arrow, also below on panel) at Denver & Rio Grande RR., Salt Lake City.

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tion concerning rates, comparisons between average bills for 1935 and 1939, and deviations from the average for the United States in all average bills from 25 to 250 kwhr.

LEFAX DATA—*Published by Lefax, Inc, Philadelphia, Pa. Recent additions to Lefax looseleaf folders include the following:* No. 11–587, "Selection of Steam Cylinder Oil"; No. 39–12, "Cooling Towers"; No. 10–80, "Geochemical Interpretation of Water Analysis"; No. 12–526, "Selection of Fans for Pipe Ventilation"; No. 39–14, "Fans for Power Plants"; No. 9–26, "Properties of Sodium Cyanide"; No. 10–110, "Laying Cast Iron Pipe"; No. 10–309, "Drives, Pulleys and Idler Spacing, for Belt Conveyors"; No. 39–15, "Insulation Computation for Boiler Walls"; No. 12–78, "Determination of Refractive Indices of Oils"; No. 13–24, "Standard Specifications for Power Piping"; and No. 39–16, "Thrust Bearings".

NEMA REPORT ON INVESTIGATION OF SMALL DIAMETER BUILDING WIRE—*Published by Rubber Covered Building Wire Section of NEMA. 24 pages, 15 photographs, 4 tables and 11 charts.* Covers an investigation of the permissible current-carrying capacity of the new small wire under various installation conditions.

PUBLIC AND INDUSTRIAL RELATIONS IN PRODUCTION—*By James H McGraw, Jr, George L Dirks, Samuel R Sutphin, J M Talbot, W W Finlay, and R F Cohn. Published by American Management Association, 330 West 42nd St, New York, N. Y.* Consisting of talks presented at one of the meetings of the AMA, this booklet gives each leader's opinions in the matter and various other data pertaining to public relations in the company and in the field. A general discussion is also included.

STRAWS

Pointing the way business winds blow

CALIFORNIA —— Metropolitan Water district, 306 West 3rd st, Los Angeles, will award contracts soon for equipment for upper feeder water-softening plant of Colorado River Aqueduct, near La Verne, including two gas- or oil-fired, horizontal boiler units; two water-cooled flue-gas coolers; flue-gas flow-meter with recorder and combustion-control apparatus; two 500-cu ft pm gas compressors; gas-flow regulating valve and auxiliary equipment.

Fruehauf Trailer Co, 10940 Harper Ave, Detroit, Mich., approved plans for addition to motor-trailer plant at Los Angeles, on site at Fruitland and Boyle Aves, Vernon district, comprising main 1-story unit, 50 x 765 ft, and several smaller structures. Cost reported about $160,000 with machinery and power equipment. Work scheduled to begin at once. H L Gogerty, 6272 Yucca St, Hollywood, Los Angeles, architect.

Burbank will award contract soon for new 750-kw turbine-generator and auxiliary equipment for municipal power station.

COLORADO —— Colorado Springs, E L Mosley, city manager, has approved plans for new 30-in. pressure pipeline for water supply from Manitou hydroelectric power plant to point near Bell Crossing. Cost estimated about $125,000. Will begin work soon.

Bureau of Reclamation, Denver, closes bids Mar 20 for station-service-generator control equipment, metal-clad switchgear, 460-volt station-service and auxili-

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3 *Highest resistance to acidity and sludge.* Because of the elimination of oxidation catalysts in addition to the unparalleled refining power of the Alchlor Process, these oils form less gum and deposits, less emulsion and sludge, when mixed with water over a period of several years continuous operation, than any other turbine oil of which we have record.

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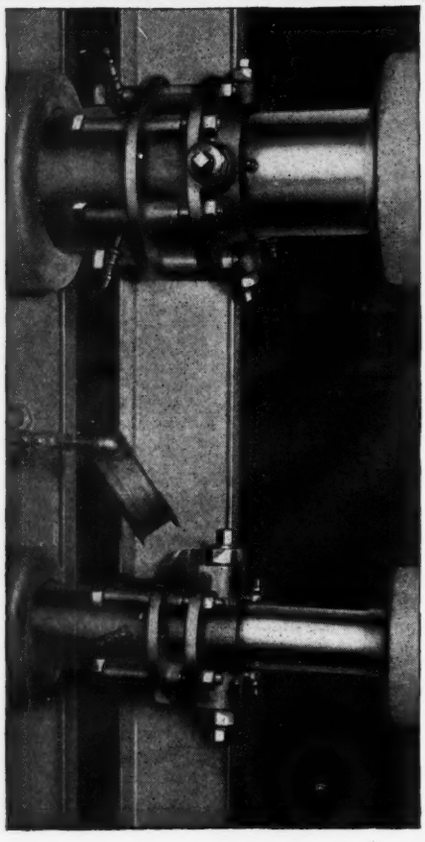

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ary power control apparatus, battery chargers, distribution equipment and auxiliary apparatus for Grand Coulee power plant, Grand Coulee, Columbia Basin project. All equipment will be installed by government (Specifications 893).

CONNECTICUT —— Connecticut Light & Power Co, Hartford, has authorized appriation of $2,600,000 for improvements in plants and system during 1940, including installation of additional equipment. A new 15,000-kva condenser unit and accessories will be installed in generating station at Waterbury, and additional equipment in stations at Norwalk and New Britain; a new dock and coal-handling apparatus will be installed at Devon.

IDAHO —— Board of Regents, University of Idaho, Moscow, has low bid from H D Powell, Moscow, at $84,000 for addition to power house at institution, including installation of new boiler unit and auxiliary equipment. Award is scheduled to be made soon. Lincoln Bouillon, Fourth Ave Bldg, Seattle, Wash., consulting engineer.

ILLINOIS —— Red Head Brand Co, 925 West Chicago Ave, Chicago, plans 1- and 2-story canvas-products manufacturing plant, 150 x 285 ft, at Belmont and Lowell Sts. Cost about $135,000, with machinery and power equipment. Hallberg & Beersman, 221 North LaSalle St, architects; Engineering Systems, last noted address, engineer.

Geneseo, has authorized plans for new municipal power plant. Estimates of cost are being made. Proposed to ask binds in spring. Warren & Van Praag, Decatur, consulting engineers.

University of Illinois has awarded contract for construction of 1-story 72'x110' boiler room and 60'x90' turbine room for power plant at university to W E O'Neil Construction Co, 2751 Clybourn Ave, Chicago, at $196,865. Sargent & Lundy, 140 South Dearborn St, Chicago, consulting engineers, while E L Stouffer, University of Illinois; is architect in charge of plans.

Salem plans pipeline system for municipal natural-gas distribution, including main-welded-steel pipeline for connection with supply source, control station and other structures. Cost about $150,000. Bond issue will be arranged soon in that amount.

INDIANA —— American Coating Mills, Inc, Elkhart, plan improvements in boiler plant at paper mill, including installation of new steel coal bunkers and other equipment. Carl A. Nelson, 1401 South Main St, South Bend, consulting engineer.

Board of Public Works, Columbia City, contracted Industrial Piping & Engrg Co, 219 East Berry St, Fort Wayne, for feedwater heater, feedwater pump, piping, valves and accessory equipment for installation in municipal power plant.

Krick-Tyndall Tile Co, Decatur, plans 2-story plant, 83 x 145 ft, to replace works recently destroyed by fire. Cost reported close to $90,000, with machinery and power equipment. Virgil Krick, superintendent.

Board of Trustees, Richmond State Hospital, Richmond, will award contract soon for new water-softening equipment for institution. John M Rotz Engr Co, Merchants' Bank Bldg, Indianapolis, consulting engineer.

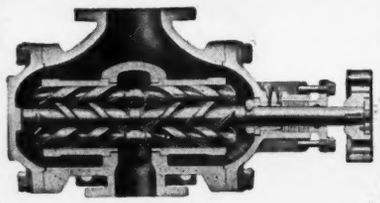
IOWA —— Gowie will award contracts soon for one 375-hp diesel and auxiliary equipment for municipal power plant, where improvements will be made. Stanley Engrg Co, Muscatine, consulting engineer.

Waverly is considering improvements in municipal power plant, including installation of new equipment. Estimates of cost will be made soon. R E Doonan, city engineer.

Iowa Electric Light & Power Co, Security Bldg, Cedar Rapids, contracted Abell-Howe Co, 53 West Jackson Blvd, Chicago, Ill., for construction of addition to local steam-electric power plant, in steam-generating division. Award for boiler units previously made to Springfield Boiler Co, Springfield, Ill. Contracts for miscellaneous equipment will be made soon. Cost estimated about $900,000.

Chamber of Commerce, Cresco, is at head of project to construct and operate a municipal electric power plant. Proposed to use diesel generators and accessories. Estimates of cost will be made soon.

Muscatine has awarded contract for furnishing feedwater heaters for municipal power plant to Elliott Co, Chicago, Ill., at $7,619, and for piping to the Groeschel Co, Marshall, Mo., at $29,381. Award



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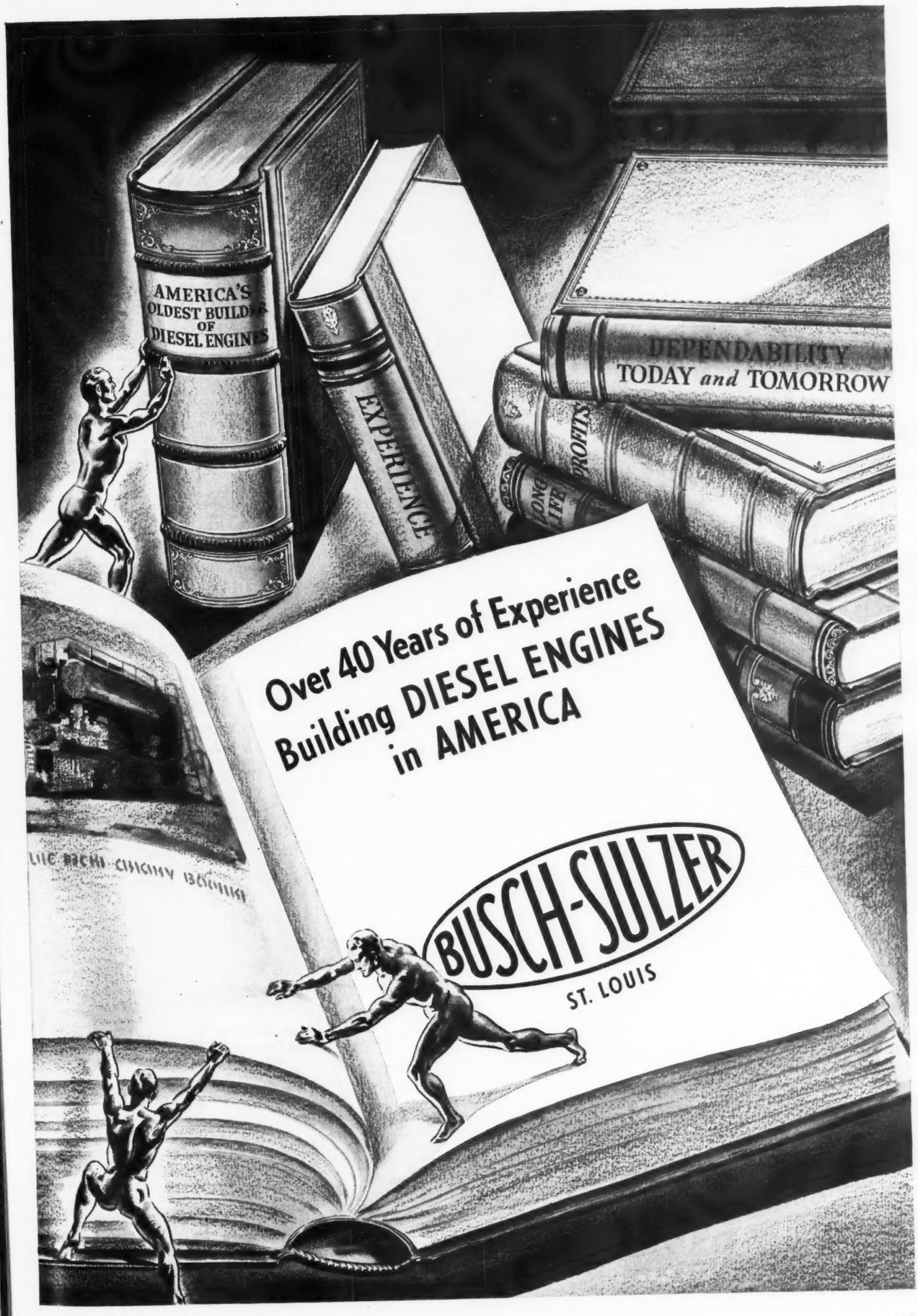
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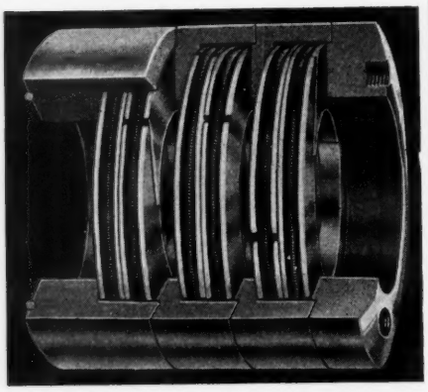

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will be made soon on coal handling equipment. Bids were opened January 15.

KANSAS —— Winfield contracted Ripstra Mechanical Construction Co, 1015 East Douglas St, Wichita, for one deaerating feedwater heater, platform, piping and auxiliary equipment for municipal power plant. Black & Veatch, 4706 Broadway, Kansas City, Mo., consulting engineers.

Sterling plans new municipal power plant to replace former station, including new building, diesel-generating units, switchboard and accessory equipment. Bond issue of $198,000 is being arranged. Burns & McDonnell Engrg Co, 107 West Linwood Blvd, Kansas City, Mo., consulting engineer.

McPherson contracted Ross Heater Co, Buffalo, N. Y., for new low-pressure heater unit for installation in municipal power plant, (Contract No. 8); will make award soon for 3-story addition to station, 41 x 58 ft. (Contract No. 9), to house new equipment for which contracts recently were let. Burns & McDonnell Engrg Co, 107 West Linwood Blvd, Kansas City, Mo., consulting engineer.

KENTUCKY —— Reynolds Metals Co, 2934 Grand St, Louisville, plans 1-story addition to metal-foil-manufacturing plant on Camp Ground Rd. Company also has purchased former local 1-story assembling works of Ford Motor Co, totaling about 107,000 sq ft and will improve and equip for new plant unit for tin and aluminum foils. Entire project will cost over $500,000, with machinery and power equipment.

Municipal Housing Commission, Lexington, C H Berryman, 600 Bluegrass Dr, executive director, plans central-heating plant at Charlotte Courts housing development, Georgetown St, Douglas Park district. Bids will be asked soon. Entire project will cost about $1,500,000. Hugh Meriwether, Lexington, supervising architect.

LOUISIANA —— Baldwin Sugar Mill, Baldwin, Randolph and Lee Roane, heads, plans rebuilding of portion of cane sugar mill recently destroyed by fire. Loss estimated about $200,000, with machinery and power equipment. New power house is planned.

MARYLAND —— Eastern Shore Public Service Co, Salisbury, plans 1-story addition to ice-manufacturing and cold-storage plant at Crisfield, to be equipped for refrigerating and freezing service for fish food. Cost reported close to $40,000, with equipment.

Board of Directors, St. Vincent's Infant Home, 6700 Reistertown Rd, Baltimore, contracted M L Robertson, 3408 Chestnut Ave, for addition to boiler plant at institution. Work will proceed at once. New boiler unit and auxiliary equipment will be installed. Crisp & Edmunds, Calvert Bldg, architects.

Hagerstown has tentative plans for improvement in steam division of municipal electric power plant, including installation of new boiler units and accessory equipment. Cost estimated close to $250,000.

MASSACHUSETTS —— Panther-Panco Rubber Co, 31 Highland St, Chelsea, manufacturer of hard rubber products, approved plans for immediate erection of new 1-story mill, 72 x 110 ft, with two L-extensions, 51 x 51 ft, and 46 x 48 ft, respectively, on Congress Ave. Cost over $80,000, with machinery and power equipment.

MICHIGAN —— Dow Chemical Co, Midland, contracted Gentry Engrg Co, Jackson, for construction of welded-steel pipeline from company plant to Temple gas-field area, Clare County, about 55 mi, for natural-gas transmission to chemical works. Cost about $400,000.

Nine Thousand East Jefferson Corp, Detroit, care of Smith, Hinchman & Grylls, Inc, Marquette Bldg, architect, plans central-heating plant in 3-story apartment building, with 3 multi-story connecting apartments, on East Jefferson Ave. Cost about $1,000,000.

Ironwood is considering new municipal power plant. Cost estimated about $950,000 with turbine-generator units and auxiliary equipment. Proposed to engage engineer soon to make survey and detailed estimates. A G Wood, city manager, in charge.

Michigan Consolidated Gas Co, 415 Clifford St, Detroit, has authorized appropriation of about $3,500,000 for improvements in plants and system during 1940. Of this amount, close to $3,000,000 will be used in city area, where about 80 mi of new pipelines will be installed, including a 22-in. high-pressure steel pipeline from Station H, Fort St

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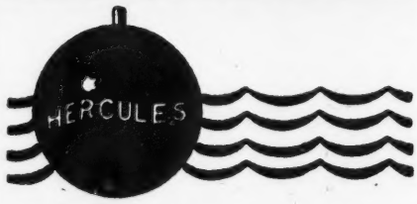

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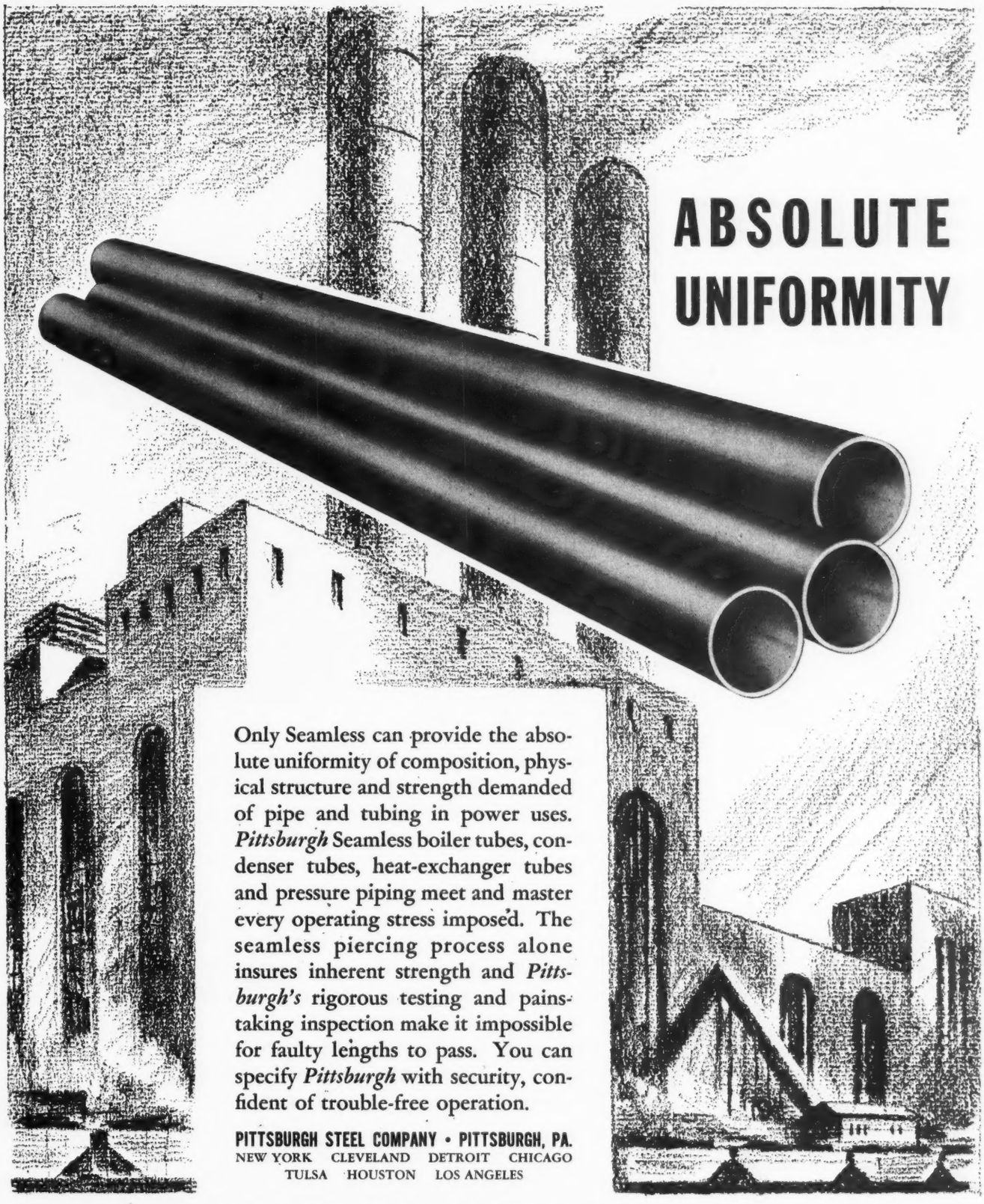

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and Green Ave, to Station B, Wight St and Meldrum Ave, East Detroit. Balance of fund will be used for pipeline additions and other operating facilities in suburban districts.

MINNESOTA — Carlton County Co-operative Power Association, Kettle River, Thomas Ross, secretary, will take bids early in March for new 400-kw power plant on local site, for power supply for rural electric system. Diesel generator units will be used. United Engr Service, 1406 West Lake St., Minneapolis, consulting engineer.

Edward Jordahl & Sons, Lake Park, meat and food products, have approved plans for 1-story cold-storage plant with locker system, comprising about 200 units. Cost close to $45,000, with equipment.

Blue Earth-Nicollet Co-operative Electric Association, Mankato, is considering new electric power plant on local site, for power supply for rural electric system, heretofore secured from Northern States Power Co. Surveys and estimates of cost will be made soon.

Le Sueur contracted Commonwealth Electric Co, 417 Broadway, St. Paul, for improvements in municipal power plant at $66,759, including installation of diesel-generator unit and accessories. Druar & Milinowski, Pioneer Bldg, St. Paul, consulting engineers.

MISSOURI — Gaylord Container Corp, Pulp and Paper Div, 2820 South 11th St, St. Louis, plans improvement in kraft paper and board mill at Bogalusa, La., including new 1 and multi-story additions, and improvements in present mill. Cost estimated close to $1,000,000, including machinery and power equipment. Work scheduled to be carried out in 1940.

Board of Public Service, St. Louis, has low bid from Robert Paulus Construction Co, 2205 Ann Ave, at $75,710 for additions and alterations in power house at Robert Koch hospital, exclusive of equipment, and will make award soon (Contract 5020). Equipment purchases are being made under separate contracts.

Webb City is considering new municipal power plant. Proposed to use diesel-generators. Surveys and estimates of cost will be made soon.

Stix, Baer & Fuller Co, owners of Grand Leader Department Store, St. Louis has awarded contracts for its proposed $400,000 air-conditioning system as follows: To York Ice Machinery Corp, 117 South 11th St, St. Louis, at about $75,000 for two compressors, totaling 1125 pounds, condensers, motors and chilling water supply for air-cooling work, and for air-distribution system to Sodemann Heat & Power Co, 2306 Delmar Blvd, St. Louis, on cost plus basis. Contracts will be let later for piping, cooling tower and other incidentals.

NEBRASKA — Hastings has engaged Black & Veatch, 4706 Broadway, Kansas City, Mo., consulting engineers, to prepare plans for improvements in municipal power plant, to include installation of New 3500-kw. generating unit and auxiliary equipment. Bids will be asked soon. Cost estimated about $280,000.

Western Public Service Co, Scottsbluff, has plans nearing completion for improvements in local steam-electric generating plant, including 2500-kw turbine-generator and accessories, oil- or gas-fired boiler and auxiliary equipment. Cost estimated close to $300,000. This is part of 1940 expansion program.

Nelson will award contracts soon for improvements in municipal power plant, including installation of two 240-hp diesels and auxiliary equipment. Cost estimated about $43,000. Robert Fulton, 2327 South 19th St, Lincoln, consulting engineer.

Wymore plans municipal power plant, with diesel-generators and accessories. Financing is being arranged. Proposed to ask bids at early date. E R Durmire, 1802 B St, Lincoln, consulting engineer.

NEW YORK — Plattsburg contracted Fulton Iron Works Co, St. Louis, Mo., at $162,012 for three 600-kw engine-generator units and accessories, for installation in municipal power plant. Awards for other equipment are scheduled to be made soon. Burns & McDonnell Engrg Co, 107 West Linwood Blvd., Kansas City, Mo., consulting engineer.

Utica Willowvale-Bleaching Co, State St, Utica, has approved plans for steam power house at mill at Willowvale, and will begin work soon. Cost reported about $40,000, with boiler unit and accessories. Lockwood Greene Engineers, Inc., 10 Rockefeller Plaza, New York, consulting engineer.

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CONTROL VALVES FOR LONG, PRESSURE-TIGHT SERVICE

Available in TWO, THREE, FOUR-WAY and Special Types for operating Air, Steam, Water or Oil Cylinders on pressures up to 300 lbs. Made in five different metal combinations to cover all mediums handled. Non-corrosive metals are used in all vital parts. Gaskets and gland packing suitable for each specific service are used.

Nicholson also offers foot, solenoid and motor operated valves and valves for hydraulic service up to 5000 lbs. pressure. Ask for Bulletin 933 describing "Nicholson" Control Valves.

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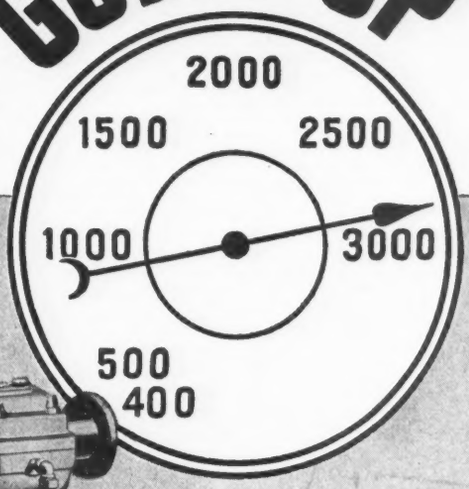

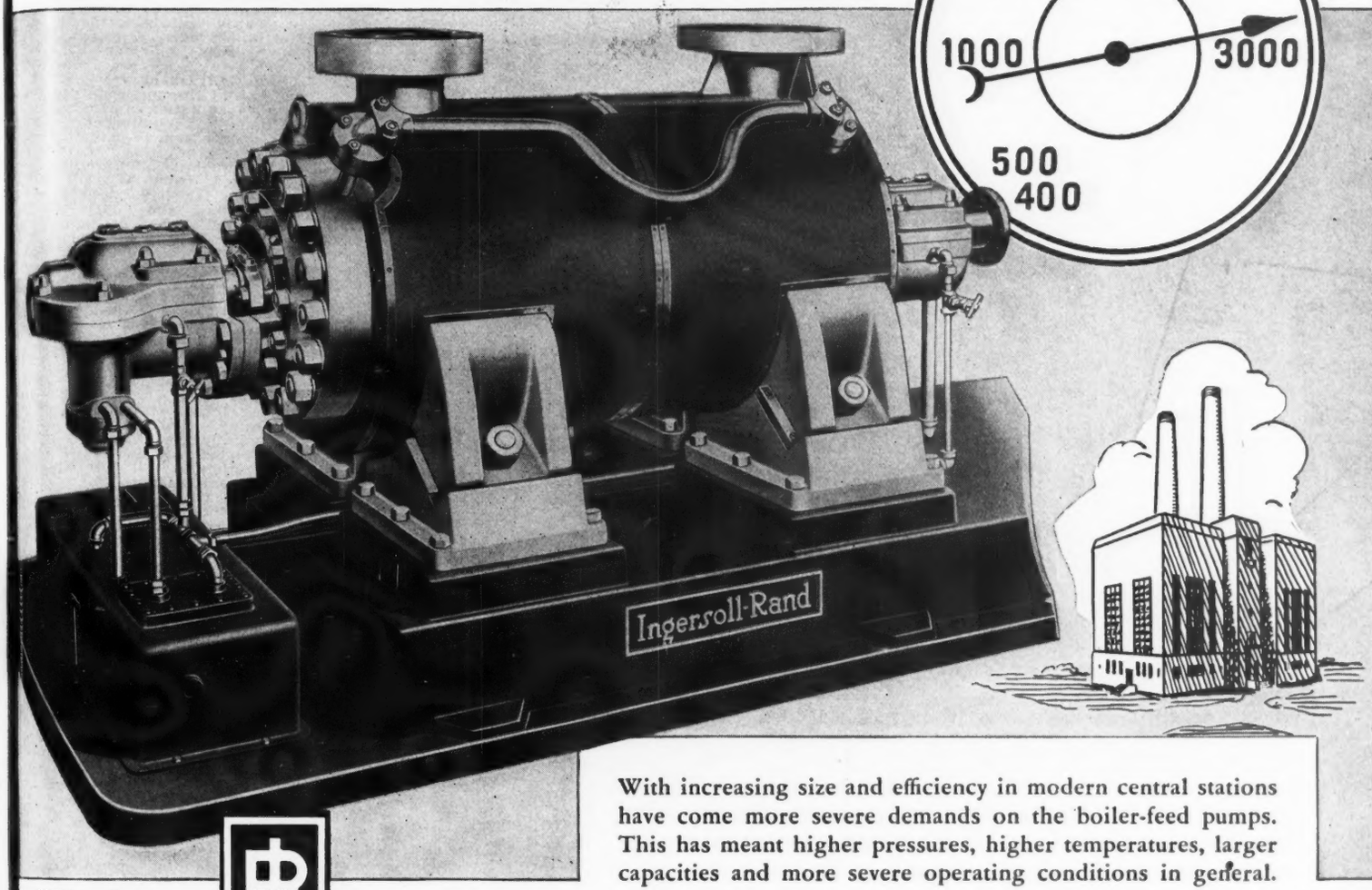

With increasing size and efficiency in modern central stations have come more severe demands on the boiler-feed pumps. This has meant higher pressures, higher temperatures, larger capacities and more severe operating conditions in general.

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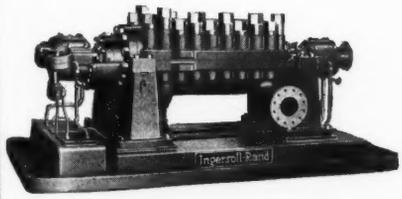

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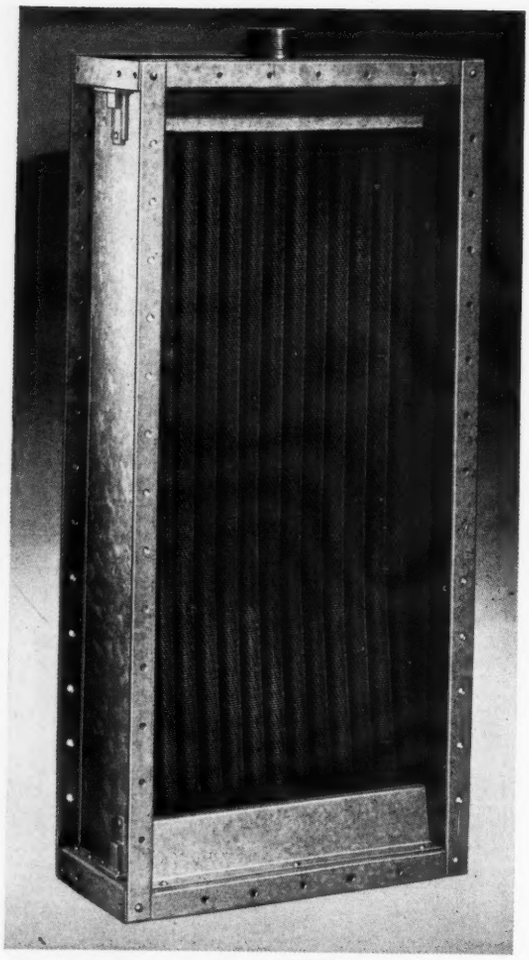

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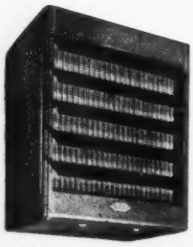

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NORTH CAROLINA —— Wilson will complete plans soon for improvements in municipal power plant, to include installation of new turbine-generator and accessory equipment. Cost about $300,000. Bond issue in that amount authorized.

OHIO —— Dayton Power & Light Co, Dayton, contracted Charles H Shook, Inc, 582 West 2nd St, for superstructure for new addition to steam-electric generating plant at Miller's Ford. Structure will cost about $100,000, exclusive of equipment, for which awards will be made separately. Entire project will cost close to $4,000,000. Roy Gillespie, chief engineer.

Oberlin, H V Zahn, city manager, is considering improvements in municipal power plant, including installation of new generator unit and auxiliary equipment. Proposed to select engineer soon to make surveys and estimates of cost.

State Dept of Public Welfare, Columbus, has low bid from W F Schmidt, Dayton, Ohio, for boiler-feed and vacuum pumps, piping and accessories for installation in power house at Miami University, Oxford; also for new radial brick stack from J M Cutshall & Son, Brazil, Ind. Awards will be made soon. Fosdick & Hilmer, Union Trust Bldg, Cincinnati, Ohio, consulting engineers.

Town & Country Locker Storage & Exchange, Inc, Tipp City, plans 1-story cold-storage plant, with locker system. Cost reported close to $30,000, with equipment. Robert L Killen, 504 Irving Ave, Dayton, Ohio, consulting engineer.

Berea is considering improvements in municipal power plant, including new generating unit and auxiliary equipment. An engineer will be engaged at once to make surveys and estimates of cost. E C Unnewehr, chairman, Light and Water Commission, in charge.

Continental Oil Co, Ponca City, plans new oil refining plant in Westlake district, Lake Charles, La., for production of high-test gasoline. It will comprise several large production units, with power house, pumping station and other mechanical departments, steel tank storage and other facilities. Proposed to begin work early in spring. Cost estimated about $3,500,000. Daniel Moran, president.

Dept of Interior, Washington, D. C., contracted Fred R Comb Co, 2113 Chicago Ave, Minneapolis, Minn., for new power house, 46 x 196 ft, at Chilocco Indian School, Chilocco, at $128,584. Installation will include one 3500-sq ft and one 1500-sq ft watertube boiler, water-softening equipment, feedwater heater and accessory apparatus. Portion of unit will be used as mechanical laundry.

OREGON —— Water Board, Eugene, has preliminary plans for new steam-electric power plant with initial capacity of 7500-kw, to be used for standby service in connection with present municipal hydroelectric generating station. Cost estimated close to $510,000. Work is scheduled to be carried out during 1940.

Evans Products Co, 15310 Fullerton St, Detroit, Mich., manufacturer of automobile loaders and other wood products, plans new plant at Marshfield, where branch mill is now being operated, consisting of several 1-story units. A power house will be built. Cost estimated over $500,000, with machinery and power equipment.

PENNSYLVANIA —— Metropolitan Edison Co, Reading, has plans maturing for improvements in steam-electric generating stations at Reading and Lebanon, to include new turbine-generator units and accessories, high-pressure boilers and auxiliary equipment. Work will be carried out as part of 1940 modernization program of company. Cost estimated close to $3,500,000.

Atlantic Refining Co, 260 South Broad St, Philadelphia, contracted Lauter Construction Co, 1613 Sansom St, for 1-story compressor-station and switch-house at oil plant, Passyunk Ave and 30th St, exclusive of equipment.

Aluminum Co of America, Inc, Gulf Bldg, Pittsburgh, is arranging fund of $30,000,000 for improvements in plants in different parts of country over a period of months, including additions to alumina works at Mobile, Ala.; metal plants at Alcoa, Tenn., with improvements in hydroelectric generating plants on Little Tennessee River, used for service at Alcoa works; new mill near Vancouver, Wash., on which work is being placed under way, to cost about $4,000,000 of total sum noted; improvements in plants at New Kensington, Pa., Massena, N. Y., Edgewater, N. J., Garfield, N. J., and other points. J. W.

How to do it?

For savings in plant operation, be sure to consider these G-E developments

NEW MAGNETIC MOTOR STARTER

Here's a new, Size 0 magnetic starter for motors up to two horsepower that is as small as many manual starters. Yet it includes (1) a push button, (2) isothermic overload protection, (3) undervoltage protection—all the advantages of a larger magnetic starter. Bulletin GEA-3250 contains complete information, and we'll be glad to send you a copy.

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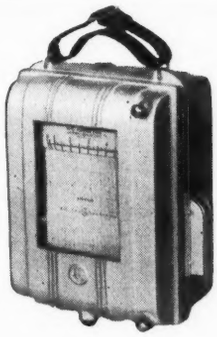
To measure building vibration caused by generators as well as excessive vibration of machinery, here's a portable, general-purpose, wide-range instrument. It measures vibration of large or small bodies in a single direction throughout any angle from horizontal to vertical. It's simple, lightweight, easy to use. Write us for details.



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You've never seen a recording instrument quite like this Type CF-1, for it's portable, inkless, and weighs only 12 pounds. There's no ink to freeze or spill or to spoil the record. And it's equally applicable indoors or out. Check the coupon for a copy of Publication GEA-3187—it contains full information on this recent addition to General Electric's complete line of electric instruments.

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You spend a lot of time planning your processes to assure uniform quality products, and here's a time switch that will be a real help when it comes to maintaining accurate processing schedules. It's a "cinch" to put a Type TSA-14 switch on any machine in your plant—no fancy installation. Find out more about this short-cycle, automatic, repeating timer by using the coupon. Check Bulletin GEA-2963A.

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For 14 years Sand-Banum has been keeping boilers and engines entirely free of scale and corrosion. Today, it is used and highly praised throughout the world. General power and heating plants find it more efficient, economical and convenient. And because it does not carry over with the steam, processing industries have found it ideal for their particular requirements!

Yet it is really different! **This pure colloidal concentrate comes in 16-ounce cans—*ready to use!* Ounces of active ingredients do a better job than hundreds of pounds of ordinary boiler chemicals. It contains no acids or harmful ingredients and each can safely protects a 250 Hp. boiler for a month; regardless of the operating conditions or the nature of the water used. Costly and time-consuming water analyses are no longer necessary when Sand-Banum is on the job and it is so easy to handle, ship and store!**

PROVE IT FIRST! Try it in your own equipment for 30, 60 or 90 days. Then, if you are not entirely satisfied with results—YOU PAY US NOTHING!

Send for FREE copy of BOILER SAFETY RULES: 42 rules that will prevent accidents, suitable for hanging in boiler room will be sent you without obligation. Write us today—

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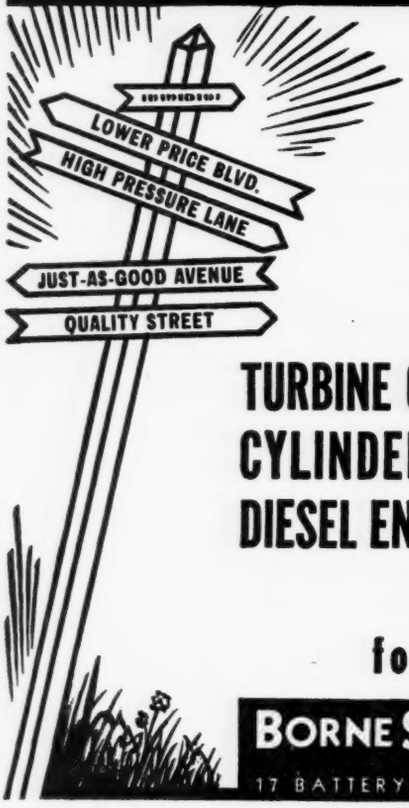

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Schreiber, first noted address, engineer.

SOUTH CAROLINA —— South Carolina Electric & Gas Co, Columbia, is arranging appropriation of about $1,100,000 for improvements in power plants and system during 1940, including installation of additional equipment.

TENNESSEE —— Maury Locker-Storage, Inc, Columbia, W P Ridley, Jr, president, contracted L S White Co, Columbia, on cost-plus basis for erection of 1-story cold storage plant, with locker system to total about 900 units. Equipment awards will be made separately. Cost reported close to $50,000, with equipment.

Tennessee Valley Paper Mills, Inc, 720 Market St, Knoxville, Gordon Browning, president, recently organized, plans power plant at proposed new pulp and paper mill for newsprint production at Savannah, where large tract of land has been secured. Also will build a pumping station for water supply for mill. Plant will comprise several large production units. Cost estimated close to $4,000,000. Financing is being completed through loan from RFC and sale of stock.

TEXAS —— Southland Cotton Oil Co, Paris, will install in Jackson Miss, mill combination gas engine steam-electric power plant of approximately 1250 hp. Paul G Bentley, Burt Bldg, Dallas Texas, Engineer.

San Antonio Public Service Co, San Antonio, is arranging appropriation of about $270,000 for improvements in gas properties in 1940, including plants, pipe line systems and other facilities.

Vernon Meat Co, Vernon, plans 2-story meat-processing and packing plant. Cold-storage and refrigerating department will be installed. Cost close to $150,000 with Machinery and power equipment. Carl Schloemann, 6329 San Bonita Ave, St. Louis, Mo., engineer.

J M Huber, Inc, 460 West 34th St, New York, N. Y., inks, carbon black, etc, contracted Koppers Co, Koppers Bldg, Pittsburgh, Pa., for natural-gas purification plant of liquid process type at carbon black properties at Borger. Plant will have capacity for handling 70,000,000 cu ft of natural gas daily, removing hydrogen sulfide from natural gas to be used for production of carbon black. New plant is said to be the largest unit of its kind ever constructed.

Austin, Guiton Morgan, city manager, is considering improvements in municipal power plant, including installation of additional equipment; also, improvements in electrical distribution system and new water intake system at filtration plant. Fund of about $150,000 will be arranged for entire project.

San Augustine, contracted Fairbanks, Morse & Co, Chicago, Ill., for diesel-generator and auxiliary equipment, at $40,447, for municipal power plant. H B Gieb & Co, Mercantile Bldg, Dallas, consulting engineers.

Houston Packing Co, Houston, contracted George Kennedy, Telephone Rd, for erection of 1-story cold-storage and refrigerating plant on Navigation St. Cost close to $30,000, with equipment.

Lower Colorado River Authority, Littlefield Bldg, Austin, contracted Marshall Ford Co, Marshall Ford Dam, at $556,341 for power plant and auxiliary structures at Marshall Ford dam. Work will begin soon.

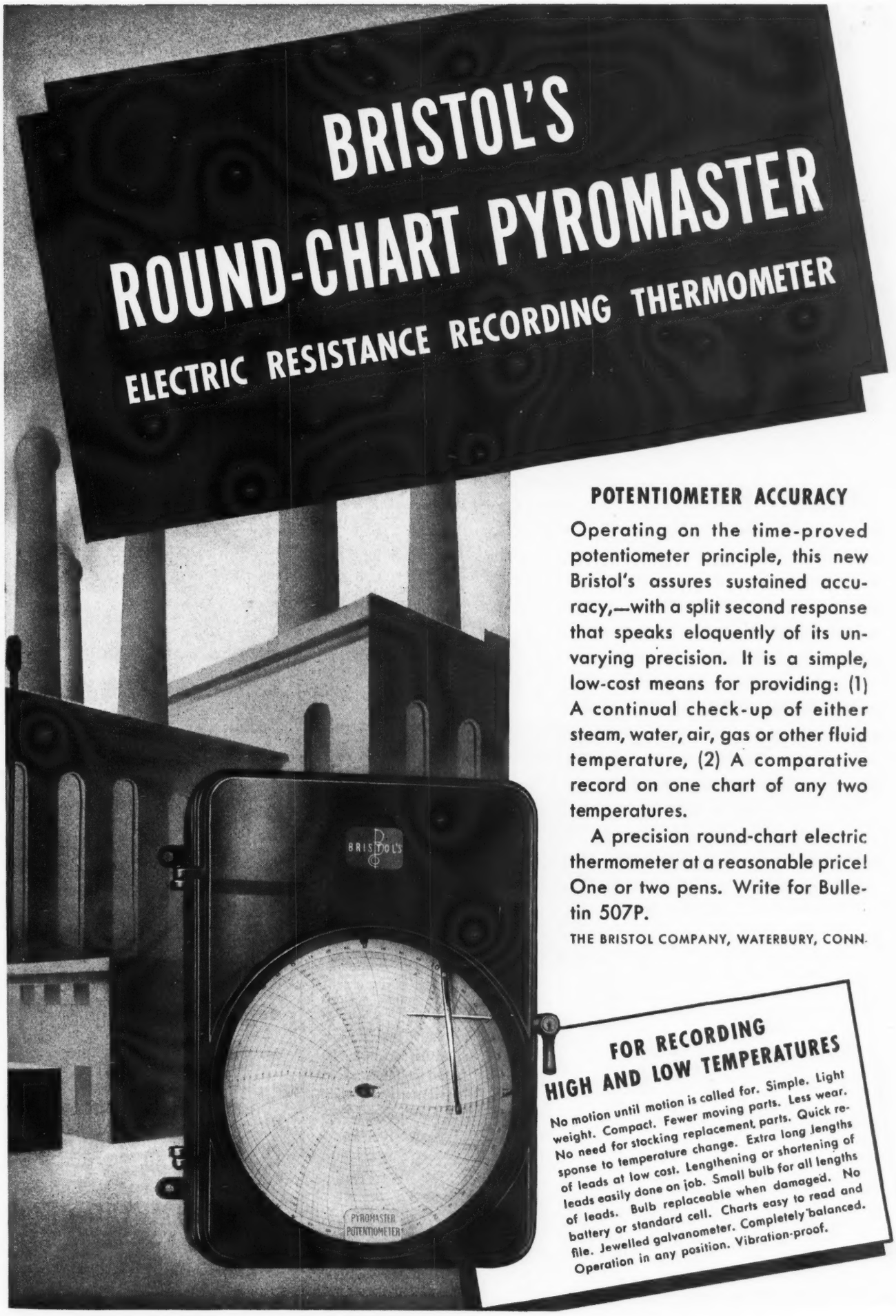
John Arledge, Bonham, is at head of project to construct and operate new 1-story cold-storage and refrigerating plant on local site. Cost estimated close to $30,000, with equipment.

VIRGINIA —— J E Sirrine & Co, Greenville, S. C., consulting and designing engineers, have let three contracts for new 480-loom weaving plant of Carter Fabric Corp, South Boston, one to Adams Electric Co, Reidsville, N. C., for installation of lighting and power wiring; to Grinnell Co, for outside fire protection and sprinkler equipment; to C M Guest & Sons, Anderson, for steam piping. Total cost of this and other improvements about $1,000,000.

Board of Trustees, Virginia Polytechnic Institute, Blacksburg, will award contracts soon for addition to central-heating plant at institution and installation of boiler unit and auxiliary equipment.

WISCONSIN —— Cambridge plans new iron removal and water softener plant for municipal water system, including two pressure filter tanks, brine tank, one 350-gpm and one 100-gpm pumping unit and complete auxiliary equipment. W G Kirchoffer, 22 North Carroll St, Madison, consulting engineer.

Tri-State Power Co-operative Association, Rivoli Bldg, La Crosse, plans early call for bids for proposed steam-electric



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Operating on the time-proved potentiometer principle, this new Bristol's assures sustained accuracy,—with a split second response that speaks eloquently of its unvarying precision. It is a simple, low-cost means for providing: (1) A continual check-up of either steam, water, air, gas or other fluid temperature, (2) A comparative record on one chart of any two temperatures.

A precision round-chart electric thermometer at a reasonable price! One or two pens. Write for Bulletin 507P.

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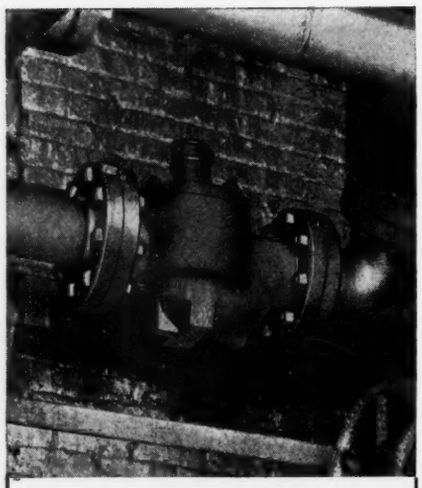
No motion until motion is called for. Simple. Light weight. Compact. Fewer moving parts. Less wear. No need for stocking replacement parts. Quick response to temperature change. Extra long lengths of leads at low cost. Lengthening or shortening of leads easily done on job. Small bulb for all lengths of leads. Bulb replaceable when damaged. No battery or standard cell. Charts easy to read and file. Jewelled galvanometer. Completely balanced. Operation in any position. Vibration-proof.



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There are uses for these sturdy meters in every industrial plant. Check your meter equipment today, then send in for complete information about the Henszey Meter.

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When you want a meter for a difficult job . . . Look for these Henszey Meter features.

- **Goes right in the line.**
- **Accurately measures flow of reciprocating pump.**
- **Operation not dependent upon close clearances.**
- **Can be calibrated in gallons, pounds, or cubic feet at any specified temperature.**
- **Sizes from 10 g.p.m. to 1,000 g.p.m. cold water rating, connections ¾" to 6".**

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generating plant on site recently selected at Genoa, to be used for power supply for rural electric system. A Y Taylor & Co, Central Bldg, Clayton, Mo., consulting engineers. Fund of $1,500,000 has been arranged for this and rural electric lines in parts of Wisconsin, Iowa and Minnesota.

Coca-Cola Bottling Co, 912-14 South 3rd St, La Crosse, plans improvements in boiler house at bottling works, including installation of new boiler unit and auxiliary equipment. Nelson & Fuchs, 115 South 4th St, architects.

Merrillan, plans reconstruction of municipal hydroelectric power plant, including installation of new hydraulic turbine unit and auxiliaries. Estimates of cost are being made. Proposed to arrange financing through Federal aid. L A De Guere, Wisconsin Rapids, consulting engineer.

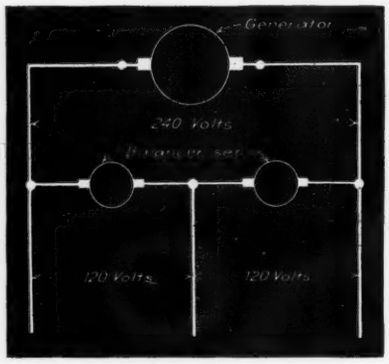
WASHINGTON — S A Moffett, 1331 Western Ave, Seattle, and associates plan 1-story cold-storage and refrigerating plant, fronting on line of Great Northern Railroad, Mount Vernon, where site has been secured. It will be used for fruit and vegetable service. Cost about $120,000, with equipment.

More Practical Aids

Causes of Trouble on Balancer Sets

BALANCER SETS consist of two direct-current machines connected in series and across a 20-wire, 240-volt dc system to provide the neutral for 120- and 240-volt 3-wire operation. The neutral wire is taken from between the two machines of the balancer set, below.

I have found slight defects, that would scarcely be noticed on a motor



or a generator, may cause serious trouble on a balancer set. Some of these are machines not level, worn bearings, brushes on either machine set slightly off neutral and rough surface on either one of the commutators. The latter is the prevalent cause of trouble.

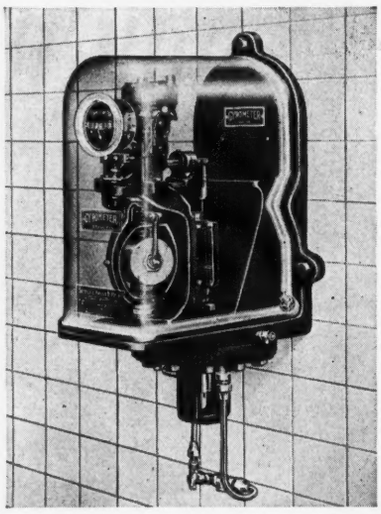
Plainfield, N. J. H W HODGSON

Gland Nuts Prevent Split File Handles

NO FILE can be considered safe unless it has a handle. Where purchased handles, with metal ferrules around their socket

AN INEXPENSIVE FLOW METER

THE SIMPLEX GYROMETER



When totalizations of boiler feed, condensate, steam and air must be accurately determined specify the GYROMETER.

Designed for use with orifices, nozzles or venturis, the GYROMETER provides an accurate and dependable summary of your flows.

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TEAR UP A $100 BILL

Every Monday!

"WE'RE on thin ice," said the President to the plant manager. "We've got to show a better profit. We can't increase prices. So that's a challenge to cut production costs."

The plant manager called his staff together and asked for suggestions. One man spoke up, "I'd like to call in . . ." The plant manager agreed. Next morning an engineer arrived—made a survey of processes where temperature, pressure, or humidity played a part. Then he went to the plant manager's office.

"As an expert on these matters," he said, "I'd say you're losing $5000 through lack of temperature control. You might as well tear up a hundred-dollar bill every Monday. But here's what you can do . . ."

His recommendations were followed. Six months later, the President again sent for the plant manager. "Congratulations!" he exclaimed. "That Taylor Temperature System you installed is already cutting production costs."

* * *

In a recent actual case of a textile mill, Taylor Automatic Controls saved $16,000 the first year. This is typical of the way it is helping industry to overcome the problems of higher taxes, of increased material and labor costs. For Taylor shows you how to attack the one cost which you can reduce—operating cost. Taylor Automatic Controls can insure the uniformity of your product . . . can reduce spoilage and speed production.

Write today for a Taylor man to make a similar free survey in your plant. No obligation of course. Taylor Instrument Companies, Rochester, N.Y. Plant also in Toronto, Canada. Manufacturers in Great Britain: Short & Mason, Ltd., London.

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PILLOW BLOCKS

Fig. 1635

Combining clamp block and pillow block requirements in one type, the "Standco" shown above is sturdily built and is offered in a wide range of sizes. Babbitted bearing surfaces are finished beautifully smooth. It can be depended on for long, trouble-free service.

"Standco" Ball and Socket Pillow Block, Ring or Wick Oiling, Plain or Collar End Babbitted Bearings.

Fig. 32

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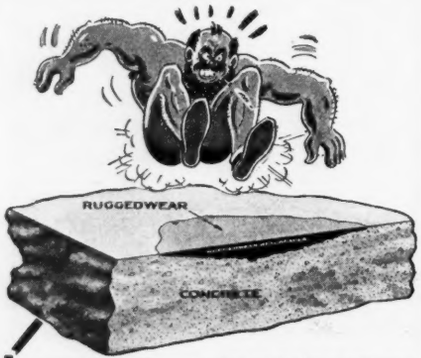

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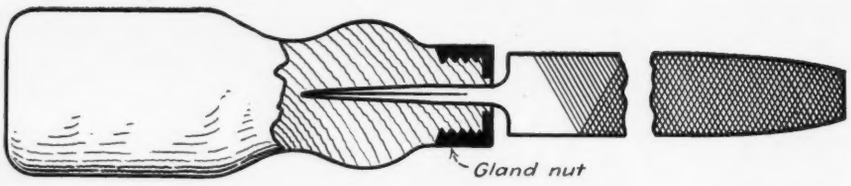
City ..... State.....



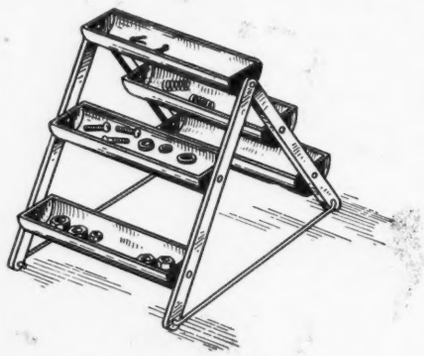
ends to prevent splitting, are not available, hardwood handles turned in the shop lathe are often substituted.

We prevent splitting of these home-made handles by using a gland nut from a discarded brass valve for a ferrule, see figure. The file end of the handle is turned down until its diameter equals the inside diameter of the nut at the thread root. We then coat the wood with glue and screw the nut on. The glue, after hardening, keeps the nut from working loose in service.

Staunton, Va. S H COLEMAN

Portable Small-Parts Tray and Rack

FROM ODDS AND ENDS and a welders torch, you can make many handy things for the plant. Neat work-bench housekeeping is possible with a small-parts

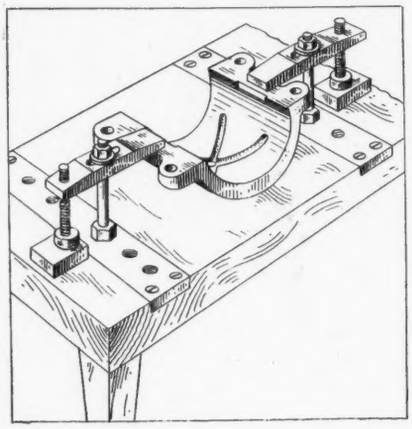


container as shown in the diagram. It is made from half sections of old boiler tube, ends being welded in. The rack is portable, can be laid out on the bench or floor near the job, or used as a stand on the bench.

Penacook, N. H. C H WILLEY

Clamping Device

WHEN THE JOB of scraping, fitting, babbitting, drilling, and cutting oil grooves in large bearing caps is being done, it is quite an aid to have the bearing cap well secured at bench



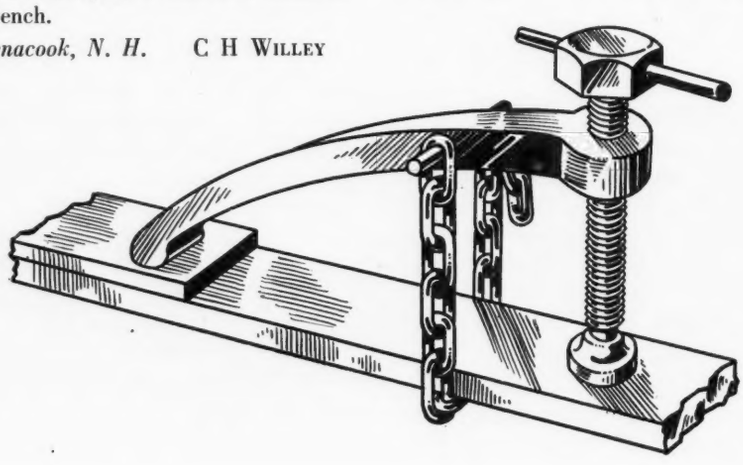
level. A couple of strips of steel that have tapped holes in them for clamping studs, as in the figure, will do this job nicely.

Penacook, N. H. C H WILLEY

Versatile Chain Clamp

THE ILLUSTRATION below tells at a glance the use of this shop-made tool, which has proved of great value in quick, easy clamping of bulky parts. The length of chain permits use in many places where other clamps won't fit. Use good steel and temper the pin! If pin ends are bent up slightly chain is less apt to work out.

Indianapolis, Ind. W H WOOD



THE ORIGINAL clip type valve with drain channels and bronze bonnet-thread-bushing . . . . . .

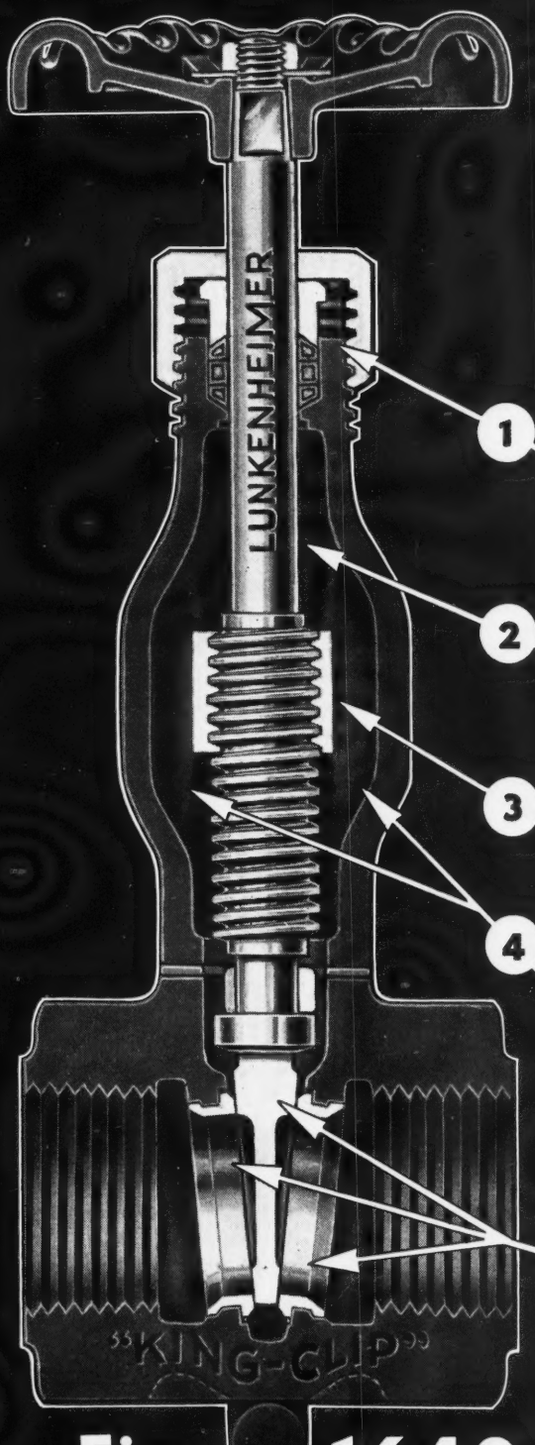


Fig. 1640

LUNKENHEIMER

Fig. 1640 "KING-CLIP"

(The King of Clip Valves)

1 **Stuffing Box**
Extra strong construction—hexagon head gland.

2 **Bronze Stem**
Perfectly aligned—repacking seat above stem threads.

3 **Bronze Bonnet Bushing—**
Cast in. Non-corrodible contact for stem.

4 **Drain Channels**
Large and unobstructed—ample size to drain bonnet. Will not clog.

5 **Bronze Disc and Rolled in Bronze Seat Rings**
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Current Comment

May Staybolts Be Welded in?

BACK IN JULY, 1939 (in Short Questions—Quick Answers, page 107), Harry Spring answered the question, "May staybolts be welded in?" by saying "Most codes allow this, but limit the stress to 6000 lb per sq in. in calculating the maximum safe pressure based on strength of the staybolts." This was based on Table P-11 (1937 edition of ASME Code for Power Boilers), in which maximum allowable stress for various forms of stays is given.

The answer started a controversy among Harry's friends as to whether this Code permitted welding of staybolts in power boilers, at all. A check with the Acting Secretary of the Boiler Code Committee showed that the reference in the Code to welding with a permissible stress of 6000 lb applied only to attachment of stay rods to crow feet or T-ends, by the forging or hammer-welding process. However, the Code did not specifically prohibit welded-in staybolts and in order to avoid any possible misinterpretation of Item E in Table P-11, the Committee acted to add the following footnote to Table P-11 and also to Tables U-6 (Code for Unfired Pressure Vessels), and L-4 (Code for Locomotive Boilers):

The reference to welded stays in Par. P-209 and to "welded stays or braces" in the above table refers to the method of fabrication by forge welding of the part itself and not to the attachment of the stays or braces to the sheets.

The proposed addition appeared in December *Mechanical Engineering* for criticism before being finally adopted for inclusion in the Code. This will eliminate any uncertainty as to the meaning of the Code provisions.

Check with Maker on Wrench-Tightening Gages

MR FRED D HOOD has brought up the question in February, 1940, POWER, of how a pressure gage is tightened by a wrench as advised by S H Coleman, when the nipple has no machined flats to which a wrench may be applied.

Many reputable manufacturers of pressure gages provide this facility and caution against twisting the case as delicate parts inside may be thrown out of adjustment. I think the answer to Mr Hood's question is to secure a guarantee from the manufacturers who omit the facility for tightening the gauge with a wrench, to the effect that they will replace any gauge made inaccurate by injury to any part due to twisting the casing in tightening or loosening the gage.—H M SPRING.

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